Malthusian Migrations*

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Abstract

For most of human history, until the fertility transition, technological progress translated into larger populations, preventing sustained improvements in living standards. We argue that migration offered an escape valve from these Malthusian dynamics, particularly after the European discovery and colonization of the Americas. We document a strong relationship between fertility and migration across countries, regions, individuals, and periods, in a variety of datasets and specifications, and with different identification strategies. During the Age of Mass Migration, persistently high fertility across much of Europe created a large reservoir of surplus labor that could find better opportunities in the New World. These migrations, by relieving demographic pressures, accelerated the transition to modern growth.

JEL codes: *$F22$,$J13$,$N33$,$O11$*
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> The germs of existence contained in this spot of earth, with ample food, and ample room to expand in, would fill millions of worlds in the course of a few thousand years.
>
> —*An Essay on the Principle of Population* (1798, p. 17), Thomas Malthus

1 Introduction

This paper studies Malthusian migrations: population movements from land-scarce, labor-abundant locations to land-abundant, labor-scarce destinations, driven by high fertility. For most of human history, the world was Malthusian and technological improvements translated into larger populations, precluding sustained increases in living standards. We argue that emigration offered an escape valve from Malthusian dynamics, particularly after the European discovery and colonization of the Americas. These migratory movements, by relieving demographic pressures, accelerated the transition to modern growth.

We extensively document the relationship between fertility and migration, showing that fertility is a major yet overlooked determinant of migration. This was the case especially during the Age of Mass Migration, between 1850 and 1920, when nearly 60 million Europeans moved to the Americas. Technological advances from the Industrial Revolution increased incomes, which, through standard Malthusian forces, raised fertility rates across much of Europe. In turn, persistently high and increasing fertility, combined with open borders and the introduction of steam-powered ships, fed migratory movements to the New World. These migrations were strongly affected by the extent and timing of fertility declines in origin countries. As societies successively underwent a fertility transition, emigration to the New World slowed. We rationalize our findings using a new model of Malthusian dynamics allowing for migration as an escape valve from population pressures.

Consider France, which experienced the earliest fertility transition, at least a century before the rest of Europe (Appendix Figure A1). At the beginning of the 18th century, France was well-positioned to send millions of its people to the New World: nearly one in five Europeans was French, and France claimed a vast swath of land in what is now Canada and the United States, New France (Appendix Figure A2). Yet, very few migrants came from France: in 1920, only 150,493 US residents were born in France; low French fertility meant limited emigration from France, making it instead a land of immigration, much like the US.

Our empirical analysis reveals that this example reflects a systematic pattern that exists across different historical and contemporary contexts. We focus on four different settings. In the first setting, we use data on the ancestral composition of countries today to explore how the timing of the transition to modern fertility affected the spread of diasporas around the world in the Post-Columbian era. In the second setting, we use census data to investigate the relationship between fertility and annual emigration rates from European countries to the

New World - Canada and the United States - during the Age of Mass Migration, both across countries and, through time, within countries. In the third setting, we use individual-level data from crowdsourced genealogies to examine how parental fertility, in conjunction with technological advancements, inheritance norms, and birth order, affected the propensity of the next generation to migrate to the New World in the 18th and 19th centuries. Finally, the fourth setting uses a contemporary cross-country panel dataset to examine the relationship between emigration and fertility today.

We uncover Malthusian migrations in each of these datasets. First, we show that the timing of fertility transitions in the Old World has driven the ancestral composition of countries in the New World today. For example, we estimate that if France had begun its fertility decline at the same time as England, 320.4 million people of French ancestry would be living outside of France today, instead of 23.8 million. Second, we document a relationship between fertility and emigration rates in sending countries over time. As countries underwent their fertility transitions, emigration slowed, and they began attracting more immigrants instead. Third, we document that this relationship is also present at the family level, where larger families faced pressures to emigrate, particularly after the introduction of steamship travel. Later-born children were particularly prone to emigrate, especially when inheritance customs were egalitarian. Finally, we find that countries with very high levels of fertility continue to have higher rates of emigration today.

Our results demonstrate a clear and consistent pattern: increasing fertility rates shaped migratory flows during the Age of Mass Migration. However, our analysis could be affected by omitted variable bias since increases in fertility are driven by increases in income per capita in the Malthusian era. This mechanism was strong enough to push living standards back towards subsistence for most of human history - and income per capita itself affects the decision to emigrate. To account for the endogeneity arising from these powerful economic forces, we introduce two instruments for parental fertility in the estimations using genealogical data. The first is linguistic distance from French, to capture the cultural diffusion of the fertility transition from France, as in Spolaore and Wacziarg (2022). The second uses twin births as a shock to fertility at the household level. In both cases, we uncover a significant positive effect of fertility on migration.

While we are the first to document the relationship between fertility and migration, the possibility that emigration provides an escape from Malthusian population pressures was acknowledged and discussed by Thomas Malthus himself in his correspondence with his friend Wilmot-Horton. While Wilmot-Horton, a politician, was a strong advocate of emigration, particularly to Canada, as a method of poverty alleviation in Britain, Malthus instead dismissed the possibility that migration to the New World could provide a durable solution to the problem of over-population in Europe, writing: "It is true as I have more than once stated, that good wages may be employed in two different ways, either so as to increase the comforts and improve the permanent condition of the labouring classes, or, to accelerate the rate of their increases; but as it is an acknowledged fact that with very few exceptions, population rapidly recovers itself, after any great loss which it has sustained, it must be allowed that experience shows the latter of the two results to be more probable than the former" (Original letter from Malthus dated February 15, 1830, as referenced in Ghosh, 1963, p. 51). This was a long-held view by Malthus, who in his *Essay on the Principle of Population*, referring to migration as a solution to the Malthusian problem, wrote that: "instead of any thing like an adequate remedy, it will appear but a slight palliative" (Malthus, 1826, p. 49). We argue here, instead, that it proved to be a powerful way to escape Malthusian forces and contributed to the transition from stagnation to modern growth in sending countries.

Our research adds to a large literature on migration, which documents the scale and characteristics of historical migration flows (Abramitzky and Boustan, 2017; Hatton and Williamson, 1994, 1998; Willcox, 1929, 1931) and examines the assimilation and economic impacts of immigrants (Abramitzky and Boustan, 2022; Abramitzky, Boustan and Eriksson, 2020, 2014; Abramitzky et al., 2023; Alesina and Tabellini, 2024; Collins and Zimran, 2019, 2023; Sequeira, Nunn and Qian, 2019; Tabellini, 2019) during the Age of Mass Migration. However, while most of this work emphasizes the consequences of migration, we focus on understanding its drivers.

Second, we add to a substantial body of literature that has examined the determinants of migration in response to economic incentives, such as Sjaastad (1962), extending to more recent contributions such as Clemens (2020). Many historical studies have shown that migration increases with widening wage differentials between sending and receiving regions (Enguehard, 2023; Hatton, 1995; Hatton and Williamson, 1994, 1998; Sánchez-Alonso, 2000*a*; Spitzer, 2014).[1] Our contribution is to focus on the fundamental forces behind economic growth and stagnation for most of human history: Malthusian dynamics. We emphasize these dynamics as significant drivers of migration.

Third, we add to a literature on long-run economic growth and the role of deep rooted factors in the process of development (Ashraf and Galor, 2011; Bouscasse, Nakamura and Steinsson, 2024; Clark, 2005; Galor, 2011, 2022; Galor and Weil, 2000; Galor and Moav, 2002; Malthus, 1798). In the Malthusian era, technological progress translated into larger populations rather than improved living standards, since fertility was increasing in income.[2] Larger populations,

[1]Non-economic and non-demographic factors, such as religious persecution, have also played a role in driving emigration. For example, studies of Jewish emigration from the Russian Empire following pogroms highlight the role of persecution, although economic factors often remain central to explaining the variation in migration patterns Boustan (2007); Spitzer (2018). Similarly, migration responses to natural disasters, such as earthquakes, have been linked to declining economic opportunities Spitzer, Tortorici and Zimran (2024). Finally, research on selection has also shown that migration decisions are shaped by economic factors, with negative selection on wages (Abramitzky, Boustan and Eriksson, 2012) and positive selection on traits such as individualism or entrepreneurial ability (Beck Knudsen, 2024; Spitzer and Zimran, 2018). Here, we focus on broader Malthusian dynamics driving migration, not on migrant heterogeneity.

[2]Relatedly, Chaney and Hornbeck (2016); Chen and Kung (2016); Clark (2016) have documented the role of demographic factors in response to major historical events such as the Black Death or the Columbian Exchange, with an adjustment period of roughly two centuries.

in turn, spurred more innovation, creating a feedback loop between technology, population, and growth, and gradually accelerating technological progress (Galor and Weil, 2000). After the Industrial Revolution, investment in education became necessary, although the Malthusian relationship between rising incomes and fertility persisted. Together, these forces further accelerated technological progress, sustaining high and increasing fertility rates across Europe, until fertility eventually declined, paving the way for sustained economic growth. Our contribution is to provide systematic evidence that high fertility drove historical migration flows from labor-abundant to land-abundant regions. Easterlin (1961) observed that there was a broad positive correlation between the rate of increase in population and overseas emigration flows, using a limited sample of 14 countries, in the second half of the 19th century. But he focused mostly on variation in mortality as driving population dynamics, and the direct relationship between fertility and migration has not been systematically investigated before.[3]

Fourth, we add to a growing literature on the causes of the historical fertility transition, in particular on the role of economic as well as cultural factors (Beach and Hanlon, 2022; Blanc, 2024*a*; Ciccarelli, Fenske and Martí Henneberg, 2023; Delventhal, Fernández-Villaverde and Guner, 2024; Gay, Gobbi and Goñi, 2023; Melki et al., 2024; Spolaore and Wacziarg, 2022). Our contribution is to document an important consequence of the gradual diffusion of modern fertility: the staggered decline in emigration.

Finally, we add a theoretical model to a mostly empirical literature on the economic impacts of emigration on sending countries (Andersson, Karadja and Prawitz, 2022; Coluccia and Spadavecchia, 2024), and particularly on Ireland (Boyer, Hatton and O'Rourke, 1994; Ó Gráda, 2019; Ó Gráda and O'Rourke, 1997; O'Rourke, 1995, 2015). Our model considers Malthusian dynamics to highlight how migration acts as an escape valve, showing how population pressures can drive migration flows and, ultimately, contribute to rising living standards.

2 Post-Columbian Population Flows, 1500-2000

2.1 Stylized fact

In this section, we present our first stylized fact, on post-1500 population flows across countries:

Fact 1. *Societies that experienced an earlier fertility transition, like France, have a smaller diaspora today.*

[3] Hatton and Williamson (1993) include a crude measure of family size in their analysis of emigration from Ireland in the aftermath of the famine, but this is only a control, and not the focus of their paper. Enguehard (2023) examines the role of income differentials, driven by Malthusian dynamics, on emigration within India and argues that low mobility prevented income equalization across regions.

2.2 Specification and data

To document this fact, our starting point is the migration matrix of Putterman and Weil (2010), which evaluates the ancestral composition of countries using a variety sources, including "genetic analyses, encyclopedias, government reports, and compilations by religious groups" (p. 1630). This matrix provides information on ascendants, that is, on the proportion of the ancestors of a country's population in 2000 who resided in that country ("same-country ascendants"), and in all the other countries in the world, in 1500. Instead, our focus is on descendants: the proportion of the descendants of a country's population in 1500 who still resided in that country in 2000 ("same-country descendants"), or resided in other countries ("diaspora in 2000"). Using the migration matrix and methodology provided by Putterman and Weil, we estimate the share of same-country descendants across countries.

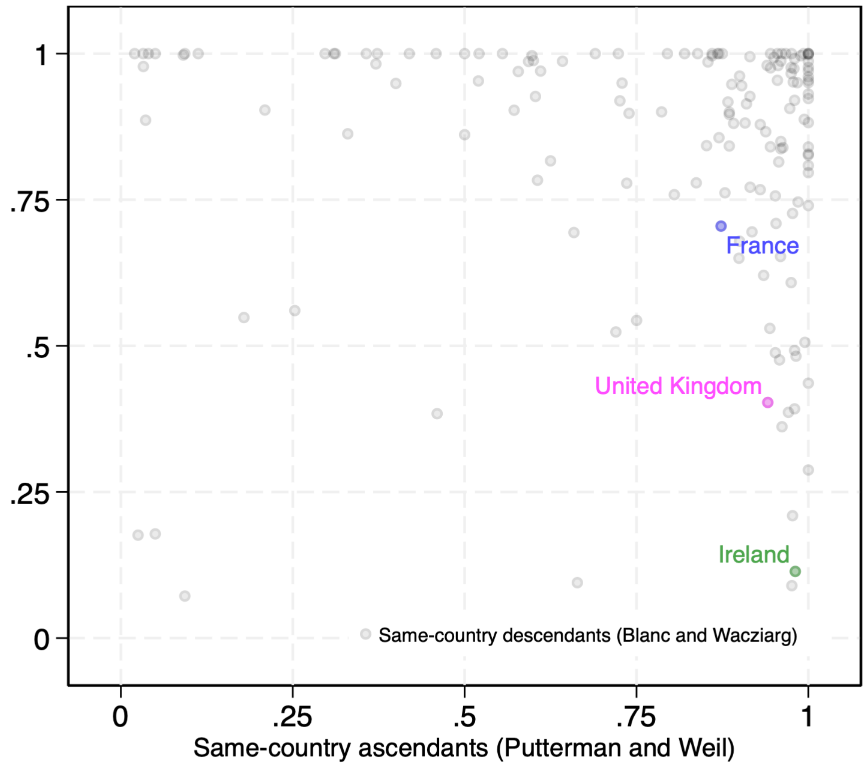
To estimate the share of same-country descendants across countries, we combine data on current populations with the migration matrix from Putterman and Weil (2010). First, we construct a matrix that shows the total number of people in 2000 who are descended from each country in the world, and their global distribution. Consider Ireland. In 2000, 98.1% of the Irish population, which was 3.7 million that year, was of Irish descent. Yet, there are more Irish-descended individuals in the US than in Ireland, as millions of Irish emigrated to the US after the Great Famine of 1845-1852. With 8.9% of the US population of 282 million in 2000 being of Irish descent, there were 25.1 million Irish-descended individuals in the US alone.

Hence, to determine the proportion of Irish descendants who remained in Ireland, we divide the number of Irish-descended individuals in Ireland by the total number of Irish-descended individuals worldwide. Our calculation reveals that only 11.4% of the descendants of the Irish population in 1500 remained in Ireland in 2000, indicating that 88.6% are descended from those who migrated away, in line with the number reported in Putterman and Weil (2010, p. 1636-7). In other words, 88.6% represents the Irish diaspora in 2000. Equation (1) generalizes this for each pair of origin country j and destination country i.

$$descendants_{i,j} = \frac{pop_{i,2000} \times ascendants_{i,j}}{\sum_i pop_{i,2000} \times ascendants_{i,j}} \tag{1}$$

Figure 1, Panel A, displays the share of same-country descendants (i.e., one minus the share of emigrants) against the share of same-country ascendants (i.e., one minus the share of immigrants). The figure shows that approximately 94.1 percent of the ancestors of the current British population were British and 87.3 percent of the ancestors of the French population were French (x-axis), suggesting that there was cumulatively more immigration to France than to Britain over the last 500 years. The figure also shows that only 40.3 percent of British descendants remained in the UK, compared with 70.5 percent of French descendants who remained in France (y-axis), suggesting that there was cumulatively much more emigration from Britain than from France. We argue that the much earlier fertility transition in France relative to

Figure 1: Post-Columbian population flows: same-country descendants and ascendants



Note: This figure displays the relationship (scatter plot) between the share of same-country descendants and the share of same-country ascendants. The share of same-country descendants is defined as the proportion of the descendants of a country's population in 1500 who still resided in that country in 2000. The share of same-country ascendants is defined as the proportion of the ancestors of a country's population in 2000 who resided in that country in 1500. Sources: authors' calculations for the share of same-country descendants, Putterman and Weil (2010) for the share of same-country ascendants.

England partly explains these stark historical differences in immigration and emigration.

Using this data, combined with estimates of the date of onset of the fertility transition (Delventhal, Fernández-Villaverde and Guner, 2024), we estimate the following specification across countries i in the Old World to establish Fact 1:

$$(2)\quad \log \text{Same-country descendants}_i = \alpha + \beta \times \text{Year onset fertility transition}_i/100 + \gamma' Z_i + \varepsilon_i$$

The dependent variable is the logarithm of the share of same-country descendants. The main independent variable is the year of onset of the fertility transition, divided by one hundred. The coefficient β therefore represents the predicted percentage change in the share of same-country descendants for a one-century delay in the onset of the fertility transition. We control, in Z, for the intensity of the transatlantic slave trade, geo-climatic characteristics, pre-industrial development, and continent fixed effects.

Table 1: Timing of the fertility transition and Post-Columbian population flows

	log Same-country descendants			
	(1)	(2)	(3)	(4)
Year onset fertility transition / 100	-0.34***	-0.34***	-0.41***	-0.41***
	(0.12)	(0.12)	(0.13)	(0.13)
Continent FEs	Yes	Yes	Yes	Yes
Transatlantic slave trade		Yes	Yes	Yes
Agricultural suitability			Yes	Yes
Pre-industrial development				Yes
Observations	93	93	89	89
Adjusted R^2	0.64	0.64	0.67	0.67

Note: This table displays the results of the OLS regression of the log of the share of same-country descendants on the year of onset (divided by 100) of the fertility transition across countries. The share of same-country descendants is defined as the proportion of the descendants of a country's population in 1500 who still resided in that country in 2000. The sample consists of countries in the Old World. Observations are weighed by population in 1500. The following set of controls are included: continent fixed effects, transatlantic slave trade (slave exports per capita between 1400 and 1900), agricultural suitability (land suitability for agriculture, percentage of arable land), and pre-industrial development (population density in 1500). Sources: authors' calculations for the share of same-country descendants, Delventhal, Fernández-Villaverde and Guner (2024) for the year of onset of fertility transition, Nunn (2008) for the transatlantic slave trade, Ashraf and Galor (2013) for agricultural suitability, McEvedy and Jones (1978) for pre-industrial development. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.3 Empirical findings

Table 1 displays the results of our estimation of Equation (2). The regressions show a strongly negative relationship between the share of same country descendants (i.e., one minus the share of emigrants) and the year of onset of the fertility transition. That is, over the course of history, countries that had an earlier fertility transition, like France, have a greater share of descendants still living in their country of origin. Whereas countries, like England, that had a late fertility transition, have a greater share of their original population living abroad. We estimate that a one-century delay in the onset of the fertility transition is associated with a 34 to 41 percent decrease in the share of same-country descendants. Adding a control for the intensity of the slave trade in the sending country, geoclimatic controls, and controls for pre-industrial development (years since the Neolithic Revolution and population density in 1500), in columns 2-4, does not change this basic picture, in fact it increases the magnitude of the correlation.[4] Figure 2 provides a graphical representation of this cross-sectional relationship, with all variables adjusted for the full set of controls from the table.

We conducted a set of further tests, presented in the Appendix. Appendix Table A1 splits the sample by continent, showing that the negative relationship does not hold significantly within

[4]In Section 4, we introduce an instrumental variables strategy in the estimation of the effect of fertility on migration in the context of individual-level regressions using crowdsourced genealogical data. In that section, we revisit the Post-Columbian cross-country results presented here and apply our instrumental variables approach to this setting. The results are qualitatively unchanged.

Africa (column 1), where forced migrations (through the slave trade) was the main factor, and within Asia (column 2) which was farther from New World destinations and less-well placed than Europeans. The latter were the first settlers of the New World, and could migrate there due to their geographic and technological advantages (Diamond, 1997). European countries were particularly well-placed to send parts of their populations to the New World at a time, toward the end of the Malthusian era, when they were experiencing high rates of population growth, and indeed we find a significantly negative relationship between the timing of the fertility transition and the share of same-country descendants in the sample composed only of European countries (column 3). Finally, columns 4 and 5 contrast the results between the Old and the New Worlds, showing that the negative relationship between the timing of the fertility transition and the share of descendants who remained is not significant for countries in the New World, as we would expect. Indeed, our thesis is expected to hold more strongly for Old World countries, which had a natural destination - the New World - for emigrants pressured out of their countries by high rates of fertility.

Appendix Table A2 shows evidence on the relationship between the timing of the fertility transition and immigration (rather than emigration) in our sample. Here, we examine how the share of same-country ascendants (i.e., one minus the share of immigrants) correlates with the timing of the fertility transition. The idea is the corollary of the previous hypothesis: Malthusian migrations imply that countries with an early fertility transition should be major migration *destinations*, because they became relatively less labor-abundant. This is indeed what we find: the share of same-country ascendants is positively related to the date of the fertility transition. A prime example of a country that became a major destination for migrants is France: during the 1850-1890 period, the contribution of immigration to overall population growth was larger in France than in the US (Melki et al., 2024).

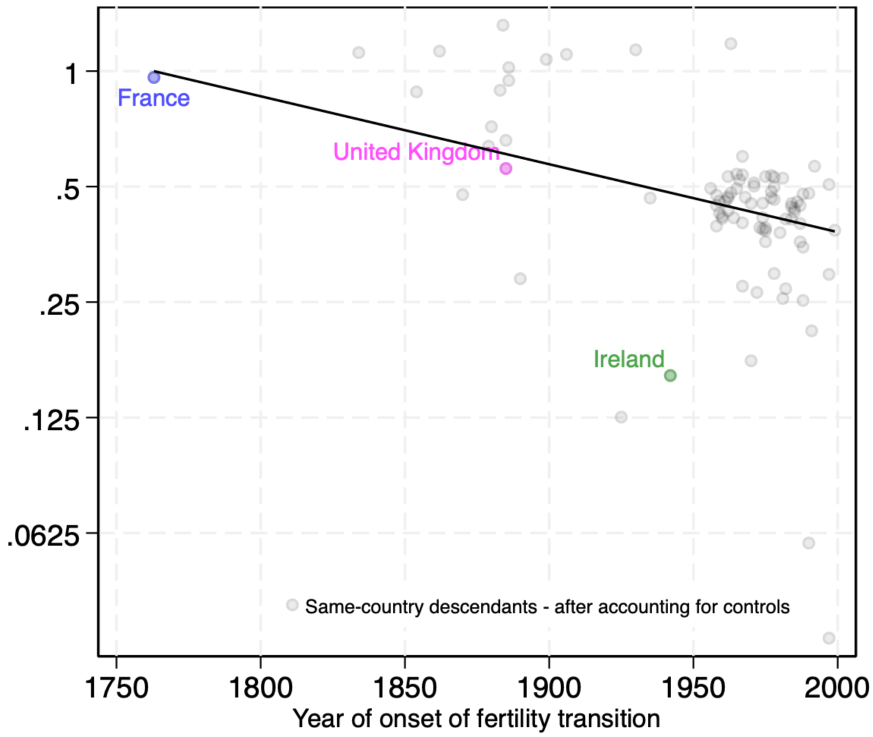
We conclude that, when looking at worldwide population movements since the discovery of the New World, countries that had an earlier date of the fertility transition tended to send fewer migrants abroad, and that this relationship is specific to the Old World and holds most strongly for European countries. Moreover, these countries have historically attracted more immigrants.

2.4 A counterfactual

These findings offers the opportunity to consider an interesting counterfactual. Currently, 23.8 million people of French ancestry live outside of France, compared with an English diaspora of 78.7 million.[5] But what if France had experienced the onset of its fertility transition at the same time as England, in 1885, instead of 1763? Our estimate of the association between

[5]Appendix Figure A1 shows that France experienced a much earlier fertility transition than the rest of Europe. While French fertility remained low throughout the 19th century, England experienced a surge in fertility resulting from the Industrial Revolution, until its transition late in that century.

Figure 2: Timing of the fertility transition and Post-Columbian population flows



Note: This figure displays the relationships between the share of same-country descendants and the timing of the fertility transition, across countries. The share of same-country descendants is defined as the proportion of the descendants of a country's population in 1500 who still resided in that country in 2000. We display the partial residual plot, after accounting for the controls from column 4 of Table 1, where observations are weighed by population in 1500. Sources: authors' calculations for the share of same-country descendants, Putterman and Weil (2010) for the share of same-country ascendants, Delventhal, Fernández-Villaverde and Guner (2024) for the year of onset of fertility transition.

the share of same-country descendants and the onset of the fertility transition, as shown in column 4 of Table 1, implies that 42.9 percent of French descendants would have remained in France, instead of the current 70.5 percent - explaining nearly all the difference with the UK, where 40.3 percent of the descendants of the British population from 1500 still reside.

However, if France had experienced the onset of its fertility transition a century later, it would be much more densely populated today. In 1750, France had a population of 24.5 million, compared to England's 5.5 million. By 2020, England's population had grown to 56.5 million, while France's only increased to 65.25 million. If the French population had grown at the same rate as the English after 1750, France would now have a population of 251.7 million inhabitants (Blanc, 2024*a*). Of these, 240.4 million would be of French ancestry, according to our counterfactual estimate of the share of same-country ascendants (Appendix Table A2). Combined with our estimate that 42.9 percent of French descendants would have remained in

France, this implies a counterfactual French diaspora of 320.4 million, instead of 23.8 million, today.[6] And the vast majority of this diaspora would reside in the New World.

France not only lost its territorial possessions but also struggled to establish a significant human presence in the Americas.[7] Our counterfactual estimate of the size of the French diaspora under a later fertility transition suggests that the face of the New World, including perhaps its dominant language, would likely be quite different from what it is today. Alfred Sauvy (1962), commenting on the early fertility transition in France compared to the rest of Europe, observed that "the difference between France and other countries, this drying up of the sap at the moment of great expansion, is the most important fact of all her history; it has determined all subsequent development and is still in action today" (p. 13). The results above suggest it was also very consequential for the rest of the world.

3 Mass Migration to the US and Canada, 1850-1920

3.1 Stylized facts

In this section, we document three further facts related to migration to the US (and Canada) during the Age of Mass Migration:

Fact 2. *During the Age of Mass Migration, emigration relative to the population of sending countries was an order of magnitude smaller for France than for the rest of Europe.*

Fact 3. *A one percent increase in marital fertility is associated with a four to six percent increase in emigration per capita, both across and within countries.*

Fact 4. *Waves of emigration cease after sending countries experienced their fertility transitions.*

3.2 Specification and data

To document these facts, we construct a panel dataset of the number of emigrants to the US from 17 European countries, every year from 1850 to 1920, using the full-count 1920 US census.[8] We use the 1920 census because the Age of Mass Migration is widely recognized to

[6]For simplicity, we assume that the share of same-country descendants (ascendants) from 1500 to 2000 is the same as that from 1500 to 2020, and that this proportion is the same in England as it is in the UK.

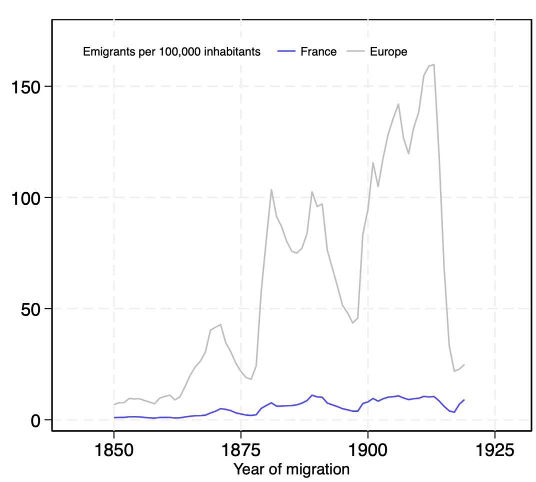
[7]Several other factors may explain why the French migrated less to the New World, as initially observed by Haines (2000); Pritchard (2004). Traditional explanations include the seigneurial system in New France, which imposed a quasi-feudal system of land tenure (Geloso, Kufenko and Arsenault-Morin, 2023); the secure land tenure enjoyed by peasants in France (Pritchard, 2004); restrictions preventing religious minorities from settling in New France; or the possibility that French emigration did not end due to declining fertility but because Quebec became English in 1763 following the Seven Years' War. Language differences in the New World may have also played a role. It's possible that these, along with other reasons, contributed to the lack of emigration from France and France's loss of New France, in addition to the Malthusian pressures we highlight.

[8]The countries of origin are Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the UK.

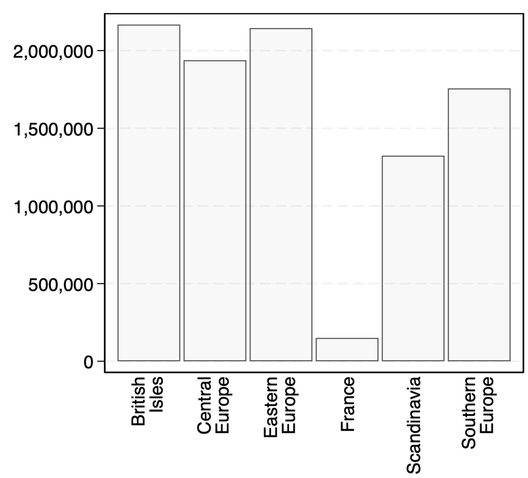
have concluded immediately after, with the Emergency Quota Act of 1921 and the Immigration Act of 1924. Additionally, using earlier censuses would result in overlooking the later waves of migration from Eastern and Southern Europe. For robustness, we also use the full-count US censuses of 1900, 1910, 1930, as well as the full-count Canadian census of 1911. These census years are the only ones that record the year and country of migration for first-generation migrants.

We combine this with data on marital fertility from Coale and Watkins (1986). In their dataset, the marital fertility index Ig captures how closely the fertility of married couples in a given population approaches a theoretical maximum based on the behavior of the Hutterites - an Anabaptist sect known for practicing no forms of fertility limitation. Appendix Figure A4 shows the availability of these data across time and space, for all the countries in the sample. Throughout the section, we interpolate missing data between two dates and cluster standard errors at the country level, but we also present results for non-interpolated years only.

Figure 3: Emigration flows to the US during the Age of Mass Migration



(Panel A) Per capita, through time



(Panel B) Total, by region

Note: This figure displays the total number of emigrants to the US from France and Europe (excluding France), relative to the population, over time between 1850 and 1920 (Panel A), and the total number of emigrants to the US by region of origin between 1850 and 1920 (Panel A), as recorded in the 1920 US full-count census. The sample includes the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the UK. In Panel B, countries are grouped into six different regions: British Isles, Central Europe, Eastern Europe, France, Scandinavia, and Southern Europe. The British Isles include Ireland and the UK; Central Europe includes Belgium, Germany, the Netherlands, and Switzerland; Eastern Europe includes Austria, Hungary, and Poland; France stands alone in its own region; Scandinavia includes Denmark, Finland, Norway, and Sweden; while Southern Europe includes Italy, Portugal, and Spain. Appendix Table A3 shows the same figure in per capita terms. Source: Ruggles et al. (2023) for migrations, Maddison Project Database (2020) for population.

Fact 2 is illustrated in Figure 3, Panel A, plotting arrivals in the US per 100,000 inhabitants from France and the rest of Europe during the Age of Mass Migration. We see a striking difference, with the extent of migration from France to the US about ten to fifteen times smaller than migration from the rest of Europe (see also Figure 3, Panel B, showing total emigrants aggregated over the 1850-1920 period, but broken down by region of origin). This difference persists throughout the period, up to the point, in 1920, when most European sending countries have witnessed the onset of their transitions to modern fertility. At that point, the Age of Mass Migration concludes.

To establish Fact 3, we consider the following specification, across countries i in the panel, for years of emigration $t = 1850, , 1920$:

$$\text{(3)} \qquad \log \text{Emigrants per 100,000 inhabitants}_{i,t} = \alpha_i + \gamma_t + \beta \times \log(Ig)_{i,t} + \gamma' Z_{i,t} + \varepsilon_{i,t}$$

In Equation (3), we have a small N (17) and a large T (69), so we cluster standard errors at the country level. The controls in Z are GDP per capita and population density (from the Maddison Project Database, 2020), year fixed effects γ_t and, in our most demanding specification, country of origin fixed effects α_i.

Table 2: Determinants of emigration flows (per capita) to the US during the Age of Mass Migration, in a panel of countries

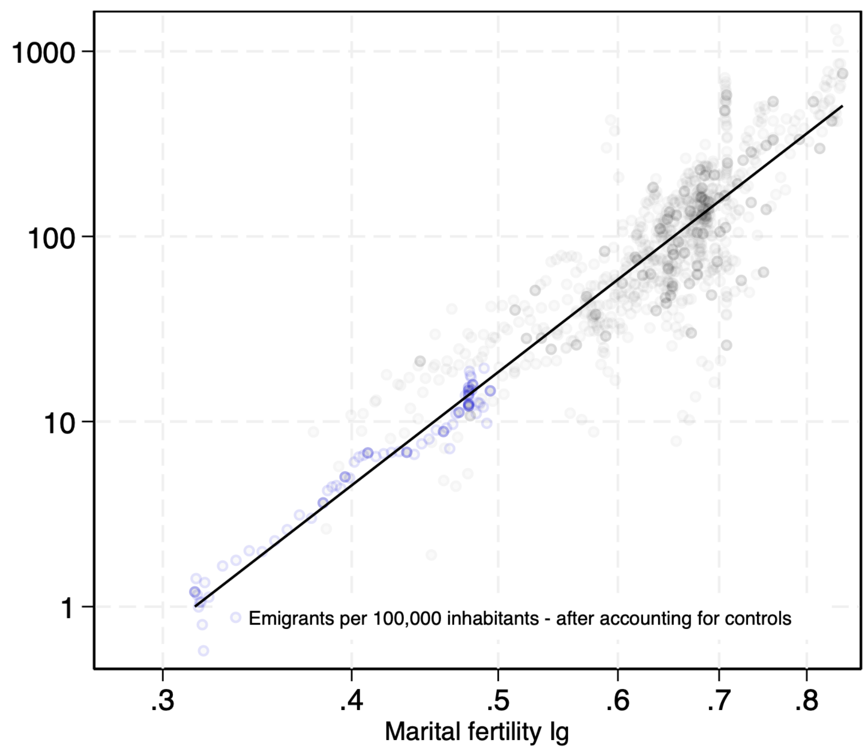
	log Emigrants per 100,000 inhabitants						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log Marital fertility Ig	4.01***	4.84***	4.15***	4.39***	4.52***	6.31***	7.53***
	(0.71)	(0.49)	(0.51)	(0.38)	(0.57)	(1.54)	(1.71)
________ × After transition							-1.45
							(1.53)
Year of migration FEs		Yes	Yes	Yes	Yes	Yes	Yes
GDP per capita				Yes	Yes	Yes	Yes
Population density					Yes	Yes	Yes
Country of origin FEs						Yes	Yes
Observations	87	68	827	827	827	827	827
Clusters (countries)	17	15	17	17	17	17	17
Adjusted R^2	0.26	0.72	0.60	0.64	0.64	0.91	0.92

Note: This table displays the results of the OLS panel regression of the log number of emigrants to the US, relative to the population of sending countries, on the log marital fertility index of sending countries, across countries and time, between 1850 and 1920. The marital fertility index Ig captures how closely the fertility of married couples in a given population approaches the maximum fertility it could experience. The sample includes the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the UK. Observations are weighed by population in the year of observation (year of emigration). Column 1 and 2 restrict the sample to non-interpolated years. In column 2, Poland and the Netherlands are excluded from the regression because their data are fully explained by the year fixed effects, due to these countries having unique census years. Source: Ruggles et al. (2023) for emigration, Coale and Watkins (1986) for fertility, Maddison Project Database (2020) for the controls. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3.3 Empirical findings

The results are displayed in Table 2. We uncover a positive relationship between the level of marital fertility and arrivals in the US. In the first two columns, we use data that are not interpolated, whereas in columns (3) through (6) we use a balanced annual panel - with little effect on the estimates. This effect barely changes with the addition of controls in columns (4) and (5), with an elasticity of about 4, and even rises in magnitude when isolating the within-country variation (column 6), where the elasticity rises to over 6. In sum, when a country has an elevated level of marital fertility, it sends many emigrants to the US, but when marital fertility is lower, it sends fewer. This result is further displayed graphically in Figure 4. The blue dots represent France, and the y-axis is on a log scale. The figure shows that even at the very low level of emigration from France, related in turn to its early fertility transition, there still exists a positive relationship between marital fertility and emigration. This positive relationship holds tightly for the rest of the sample as well.

Figure 4: Determinants of emigration flows (per capita) to the US during the Age of Mass Migration, in a panel of countries



Note: This figure displays the partial residual plot between the log number of emigrants to the US and the log marital fertility index of sending countries, across countries and time, after accounting for the controls from column 6 of Table 2. The blue dots represent France, while lighter dots represent interpolated years. Further details are provided in Table 2.

In Table A3, we show regression results relating migrant arrivals to the fertility rate of sending countries, with country fixed effects and multiple controls, using data from various US censuses and the 1911 Canadian census. Across all these samples, we find a positive association between log marital fertility and log emigrants per $100,000$ inhabitants, again with relatively high elasticities across US census years (1900, 1910, 1920, 1930). An interaction term between fertility and an indicator that takes on a value of one if a country has already undergone the onset of its fertility transition, as estimated by Coale and Watkins (1986), takes on a negative coefficient, but it is usually insignificant. In other words, the effect of fertility on migration continues to hold after countries have initiated their fertility transitions.[9]

Finally, to illustrate Fact 4, we display in Figure 5 the number of emigrants to the US (per $100,000$ sending region inhabitants) from different regions of Europe over time, i.e. annual migrant net arrivals. Corresponding figures country-by-country appear in Appendix Figure A6. Dotted lines represent the year of onset of the fertility transition, from Coale and Watkins (1986).[10] Take the cases of Central Europe (Belgium, Germany, Netherlands, Switzerland) and Southern Europe (Italy, Portugal, and Spain). Using the Coale and Watkins data, we estimate the date of transition of these regions (obtained as the population-weighed average of the underlying countries' dates) as occurring in 1888 and 1913, respectively. We see that, in the period following these dates, emigration to the US from these source regions falls dramatically. Similar patterns are observed in other regions, and country by country. In other words, waves of migration cease after the sending countries initiate their fertility transitions. These patterns are consistent with the observations in Hatton and Williamson (1998) that waves of European arrivals to the US during the Age of Mass Migration followed a spatial pattern that started in Northwestern Europe and gradually moved toward Southern Europe. This was also broadly the pattern of sequencing of the fertility transition in Europe.[11]

4 Crowdsourced Genealogies, 1750-1900

4.1 Stylized facts

In this section, we use individual-level data from crowdsourced genealogies to document five further facts:

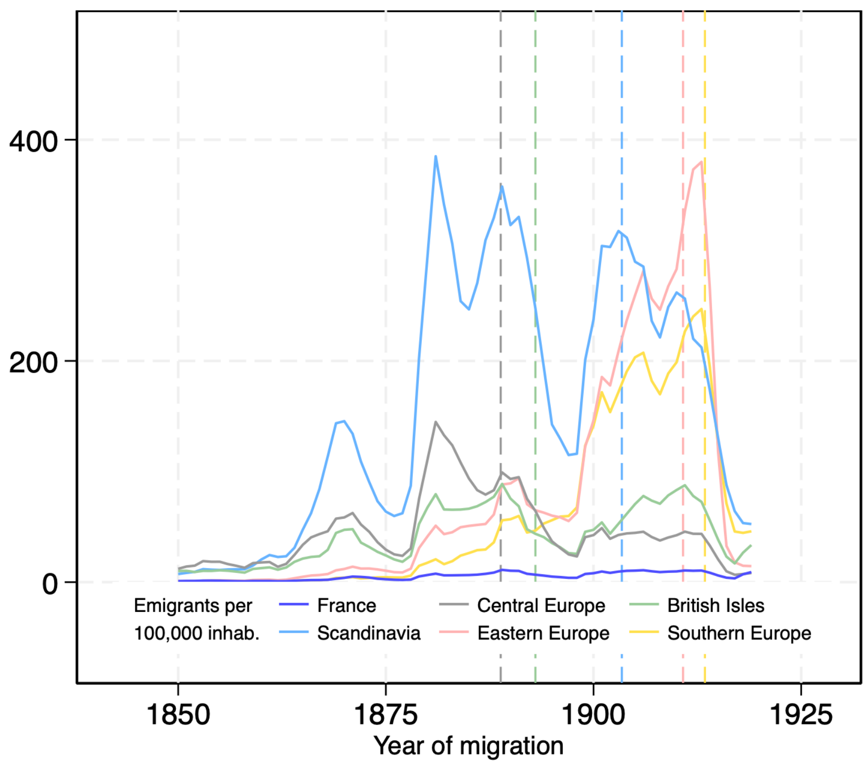
Fact 5. *An increase in parents' fertility raises the likelihood that one of their children emigrates to the New World.*

[9] It is important to remember that the Coale and Watkins date of transition represents the year at which a first sustained decline of 10% in the marital fertility date has taken place - in other words, it is the beginning of the process of fertility reduction. It is not surprising, then, that the relationship between fertility levels and migration would continue to hold even after this date. We note also that the Coale and Watkins date of onset likely *postdates* the behavioral changes toward reducing marital fertility, because it relies on estimates of females' completed fertility between ages 20 and 40. For instance, data on dates of the fertility transition from Delventhal, Fernández-Villaverde and Guner (2024), based on annual birth rates, show fertility transition dates that are on average 15 years earlier than those of Coale and Watkins. On average, then, it is reasonable to posit a delay of about 20 years between the date of onset of the fertility transition, and the peak of migration waves from the countries in our sample to the New World.

[10] Note that France's fertility transition onset took place before the period displayed on the figure.

[11] In our data, there is low emigration from Spain to the US, consistent with Sánchez-Alonso (2000*b*), who finds instead high levels of emigration from Spain to Latin America. Consistent with Spain's late fertility transition, these high levels of emigration are only observed after 1900.

Figure 5: Emigration flows (per capita) to the US during the Age of Mass Migration, across regions of Europe



Note: This figure displays the total number of emigrants to the US from regions of Europe, relative to the population, between 1850 and 1920, as recorded in the 1920 US full-count census. We also plot (in vertical lines) the year of the onset of the fertility transition for these regions, as estimated by Coale and Watkins (1986). The sample includes the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the UK. Countries are grouped into six different regions, as in Figure 3, Panel B. Appendix Figure A5 display the figures region-by-region. Source: Ruggles et al. (2023) for emigration, Maddison Project Database (2020) for population.

Fact 6. *The relationship between parents' fertility and the propensity of their children to migrate to the New World becomes stronger after the introduction of transatlantic steam-powered travel.*

Fact 7. *Malthusian pressure only drove migration to the New World, not within the Old World.*

Fact 8. *Individuals born in regions with equal inheritance rules where more likely to migrate when parental fertility increased.*

Fact 9. *Within households, later born children were more likely to migrate when parental fertility increased.*

4.2 Specification and data

To document these facts, we use crowdsourced genealogical data from geni.com, as provided by Blanc (2024*b*). This data builds on the *familinx* dataset originally introduced by Kaplanis et al. (2018), but has been enhanced with improved geocoding, fertility measurements, and historical urbanization data. It contains 10 million individuals, linked intergenerationally, who either were born or died in Europe. Additional details are provided in Blanc (2024*a*), who uses these data for France to reconstructs fertility from horizontal lineages, and in Blanc (2024*b*), who extends this methodology to reconstruct fertility, longevity, and migrations series in Europe, and, comparing these to representative sources, finds limited selection in the 18th and 19th centuries. We include in our sample individuals born between 1750 and 1900, with parents in the fertility sample, in a set of 30 European countries.[12]

Figure 6 displays migration status and destinations over time, plotted against year of birth, for individuals in the crowdsourced genealogical data. We classify individuals as stayers if they died in the same municipality where they were born. Conversely, those who died in a different municipality from their birthplace are classified as migrants. Among migrants, we distinguish four types: within Europe, those who died in a municipality classified as rural or urban at the time of their birth; and, outside of Europe, those who died in the New World, located west of 30°W longitude, and those who died elsewhere.

Several observations stand out. First, only one-third of those born in the late 17th century were migrants, but by the late 19th century, this proportion had risen to over two-thirds. Second, throughout the entire period, about 20 percent of those in our sample were migrants who died in Europe in a municipality that was rural at the time of their birth. These migrations were usually short-distance, less than 80 kilometers away, often for the purpose marriage (Blanc and Wacziarg, 2020). Third, only 8 percent of those born in the late 18th century were migrants who died in Europe in a city (coded as urban at the time of their birth), but this number grew to 22 percent by the late 19th century, reflecting rural flight and urbanization. Finally, migration rates to the New World increased from 5 to 18 percent over this period.

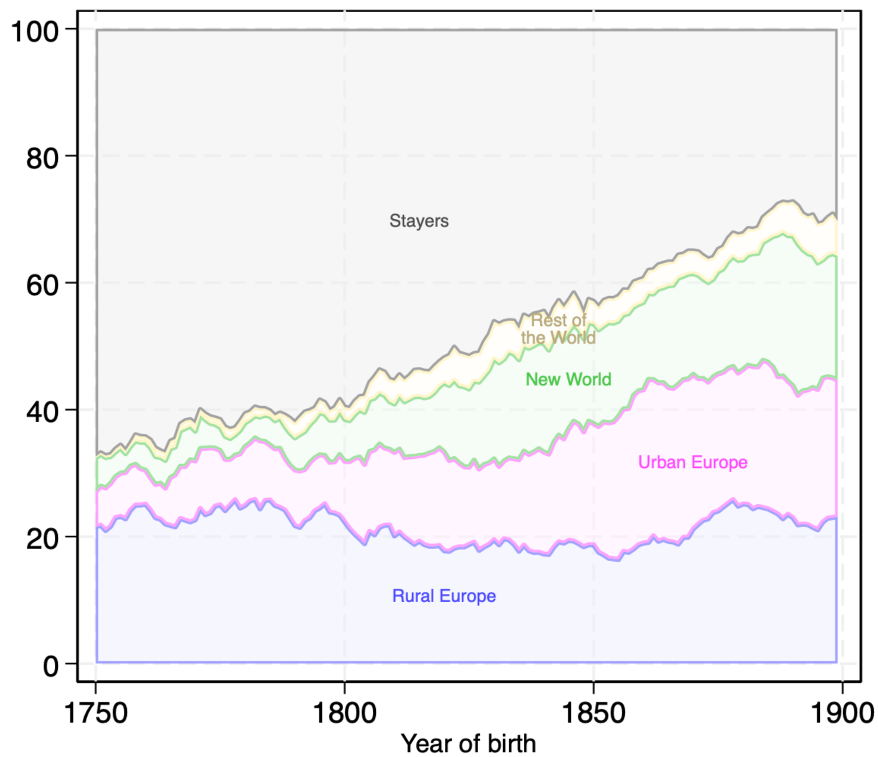
Using this data, we estimate the following specification to provide evidence for Fact 5:

$$\mathbb{1}(\text{Migrant to New World}_{i,t}) = \alpha_{r(i),t} + \beta \times \log \text{Parental fertility}_{i,t} + \gamma' Z_{i,t} + \varepsilon_{i,t} \tag{4}$$

The dependent variable is a dummy variable taking on a value of 100 if individual i, born in Europe in year t, between 1750 and 1900, died in the New World. The main regressor of

[12] These countries are: Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, North Macedonia, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the UK. In addition, following Blanc (2024*a*), we restrict the sample to observations with parents in the fertility sample, for which we can be fairly certain that the data includes complete information on horizontal lineages (i.e., siblings), to ensure a reliable measure of fertility. The method used to restrict the sample to observations with complete horizontal information is also adopted by Blanc (2024*b*); Gay, Gobbi and Goñi (2023).

Figure 6: Migration destinations over time in the crowdsourced genealogical data



Note: This figure displays the share of individuals born in a given year who died in the same municipality as their municipality of birth (stayers) or in a different municipality from their municipality of birth (migrants), against year of birth. Further details on our categorization of migrant types are provided in the text. The sample consists of individuals born between 1750 and 1900 in Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, North Macedonia, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, or the UK, and with parents in the fertility sample. To account for the over-representation of some countries, observations are reweighed using the scheme provided by Blanc (2024*b*). Sources: Blanc (2024*b*).

interest is the log of parental fertility, i.e. the log of one plus the number of siblings of i. We include, in Z, controls for demographics (age at death, gender), the caloric suitability of place of birth, the urbanization status of the municipality of birth (at the time of birth), year of birth, as well as country or NUTS2 region of birth by year of birth fixed effects. Finally, since some countries are overrepresented in the crowdsourced data and others underrepresented, we weigh observations by country of origin population following Blanc (2024*b*).

4.3 Baseline results

Table 3 presents linear probability model estimates of Equation (4). We find a consistent positive association between the log parental fertility and the likelihood that their offspring migrated to the New World, including in the specification with the largest set of controls and

Table 3: Individual-level determinants of emigration to the New World

	Dummy = 100 if died in New World					
	(1)	(2)	(3)	(4)	(5)	(6)
log Parental fertility	4.32***	4.25***	3.24***	2.87***	3.08***	2.57***
	(0.25)	(0.25)	(0.26)	(0.24)	(0.25)	(0.22)
Year of birth FEs	Yes	Yes	Yes	Yes	Yes	Yes
Caloric suitability and urbanization		Yes	Yes	Yes	Yes	Yes
Country of birth FEs			Yes	Yes	Yes	Yes
Country of birth × year of birth FEs				Yes		Yes
Region of birth FEs					Yes	Yes
Region of birth × year of birth FEs						Yes
Observations	241,130	225,333	225,333	225,084	225,327	219,193
Adjusted R^2	0.05	0.06	0.11	0.18	0.16	0.32

Note: This table displays the results of the OLS regression of a dummy = 100 if an individual died in the New World on log parental fertility. An individual is recorded as having died in the New World if they died in any location west of 30°W longitude. Standard errors are clustered at the parents level. The sample consists of individuals born between 1750 and 1900 in Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, North Macedonia, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, or the UK, and with parents in the fertility sample. To account for the over-representation of some countries, observations are reweighed using the scheme provided by Blanc (2024*b*). The following set of controls are included in all specifications: age at death and gender. Starting column 2, caloric suitability and urbanization include caloric suitability in the municipality of birth and the urbanization status of the municipality of birth at the time of birth. Sources: Blanc (2024*b*) for the genealogical data, Galor and Özak (2016) for caloric suitability, Bairoch, Batou and Chèvre (1988) for urbanization. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

region of birth by year of birth fixed effects (column 6).[13] Using the estimate of that column, the probability of migrating to the New World rises by 0.60 percentage points when comparing individuals born in households with 3 children to those born in households with 4 children, and 0.47 percentage points when going from 4 to 5 children.[14] This is in comparison with an average migration probability to the New World of 6.6 percent for individuals born before 1825, and 17.1 percent after. This result is further displayed graphically in Figure 7 as a binscatter plot, showing a particularly strong relationship between the likelihood of migrating to the New World and log parental fertility, especially past the third child.

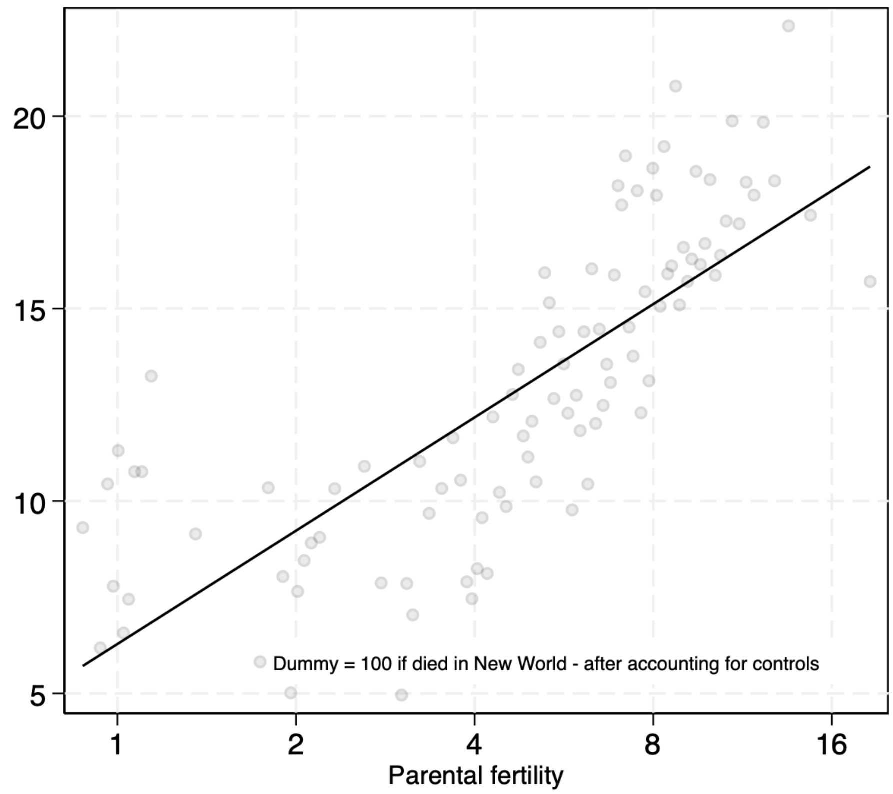
4.4 Instrumental variables estimates

We address two identification concerns. The first concern is omitted variables bias. Indeed, the fundamental characteristic of Malthusian dynamics, leading to economic stagnation, is that fertility increases with income (Ashraf and Galor, 2011; Galor, 2011, 2022; Galor and Weil, 2000; Galor and Moav, 2002; Malthus, 1798). We do not observe household income in the crowdsourced genealogies. However, an increase in income in sending countries should decrease the benefits of migration (Hatton, 1995; Hatton and Williamson, 1994, 1998; Sjaastad,

[13] Appendix Table A4 shows the robustness of our results to restricting the sample to individuals born between 1775 and 1875, a sample restriction we adopt below for our IV regressions. If anything, the estimated coefficients are slightly stronger.

[14] Since we are including region by year of birth fixed effects, we are estimating the effect of parental fertility *controlling for* community level fertility, where the relevant community is defined at the NUTS3 regional level. This shows that the pressure toward Malthusian migrations existed at the family level independent of community-level pressure.

Figure 7: Individual-level determinants of emigration to the New World



Note: This figure displays the binscatter between a dummy = 100 if an individual died in the New World and log parental fertility, after accounting for the controls from column 2 of Table 3, and setting the number of bins to 100. Further details are provided in Table 3.

1962). This would bias our estimates toward zero.[15] The second concern is reverse causality. For instance, during the Age of Mass Migration, parents could have increased their fertility expecting that some of their children would migrate to the New World. To address these concerns, we develop two separate instrumental variables approaches.

In our first approach, we use linguistic distance from French in the municipality of birth of an individual as an instrument for parental fertility. This approach exploits the cultural diffusion of the historical fertility transition in Europe, drawing on Spolaore and Wacziarg (2022), who document that regions speaking languages closer to French experienced an earlier transition.[16]

[15]A related argument, that leads to bias in the same direction, is based on the observation that, during the Age of Mass Migration, migrants were negatively selected from the sending population (Abramitzky, Boustan and Eriksson, 2012). As Malthus observed in a 1823 letter to Wilmot-Horton: "the principal objection which strikes me, is, that the character of the population which parishes are most inclined to get rid of would not in general make the most industrious and efficient settlers" (Ghosh, 1963, p. 48).

[16]For example, in Belgium, the French-speaking region of Wallonia had a much earlier fertility transition than the Flemish-speaking region of Flanders (Lesthaeghe, 1977). More broadly, Spolaore and Wacziarg (2009) argue that cultural

Our argument is that linguistic distance from French predicts fertility after the onset of the fertility transition in France but is not otherwise expected to affect the probability of migrating to the New World.[17] The idea is that modern fertility behavior followed very different paths of diffusion than that of the technological innovations that powered the Industrial Revolution. The latter diffused from England, as emphasized by Spolaore and Wacziarg (2009), in ways related to cultural distance from the English rather than the French. Our results are indeed unchanged when controlling for linguistic distance to English.

Figure 8 shows the historical linguistic landscape of Europe in our data. The map displays the borders of municipalities, of dialects, and of languages, as well as variation in linguistic distance from French. To compute linguistic distance across 100,908 municipalities, we digitized the historical linguistic map from **MuturZikin**, as displayed in Appendix Figures A7 and A8. We first assign dialects and languages to municipalities of birth in the crowdsourced genealogical data. Then, we match the 418 dialects and 112 languages in MuturZikin to 77 corresponding languages in the Ethnologue linguistic tree (Eberhard, Simons and Fennig, 2021) and calculate the cladistic distance between these languages and French, that is the number of different nodes separating these languages in the Ethnologue, following Desmet, Ortuño-Ortín and Wacziarg (2012); Spolaore and Wacziarg (2016).[18]

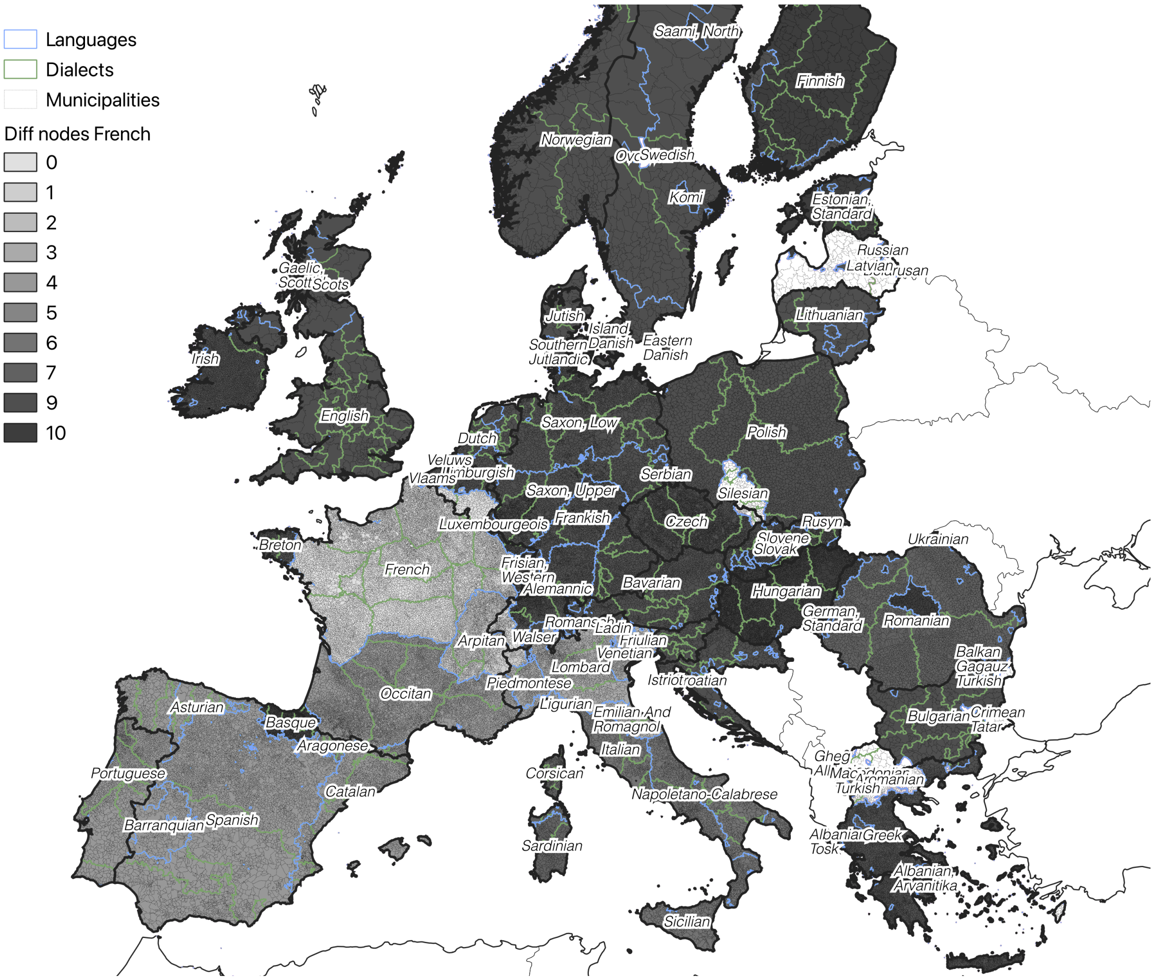
To buttress our argument that linguistic distance from French is a plausible instrument for fertility, Figure 9 reports the results of an event-study approach to the first stage relationship. We display the coefficient on successive interaction terms between 25-year period dummies and linguistic distance from French, before and after the fertility transition in France. The baseline period is 1750-1775, when French fertility declined (Blanc, 2024*a*; Delventhal, Fernández-Villaverde and Guner, 2024). The effect becomes significant only after the onset of the fertility transition in France, suggesting that linguistic distance from France does not capture fixed institutional characteristics that may also directly affect the propensity to migrate, such as the degree of collectivism (Beck Knudsen, 2024), or some fixed propensity of the French, and those linguistically close to them, to prefer to stay close to home. Additionally, Figure 9 shows that, after 1760, the effect of linguistic distance on fertility first rises as French norms spread, and then falls when most households have transitioned to modern fertility. This pattern is

distance captures barriers to the diffusion of innovations. Here, the innovation is fertility controls.

[17]The linguistic distance instrument is also applicable to the specification presented in Section 2, linking Post-Columbian migration flows to the timing of the fertility transition: linguistic distance from French is also predictive of the timing of the fertility transition across countries. We carry out this analysis in Appendix Table A5, Panel A. We find that the coefficient on the transition date is slightly smaller than the corresponding OLS estimate on the same sample (column 4), but that it remains negative and highly significant. In Appendix Table A5, Panel B, we further focus on Post-Columbian population flows from Europe, using the same IV strategy as in Panel A. We find a significant negative effect of the timing of the fertility onset when instrumenting with linguistic distance from French. Finally, in Table A6, we conduct robustness checks on this IV exercise. In particular, we add the linguistic distance to English and linguistic distance to English and Spanish, as controls in both the first and second stages. In all cases, we still uncover a negative relationship between the timing of the onset of the fertility transition, and the extent of Post-Columbian migrations.

[18]In the context of France, Blanc and Kubo (2024) demonstrate a strong correlation between cladistic distance and other, more continuous measures, such as Levenshtein distance.

Figure 8: European languages and linguistic distance from French



Note: This map displays the historical linguistic landscape of Europe, with the borders of municipalities (gray), dialects (green), and Ethnologue languages (blue), as well as variation in linguistic distance from French. Further details are provided in the text.

consistent with a model of diffusion of modern fertility norms, and validates the main findings in Spolaore and Wacziarg (2022) with individual-level data.

The second approach employs twin births as random shocks to parental fertility, drawing on a large body of literature, e.g., Clark, Cummins and Curtis (2020); Rosenzweig and Wolpin (1980). Twin births increase fertility but are otherwise plausibly exogenous with respect to the decision of the offspring to migrate to the New World, as they represent an unexpected shock to household total fertility.

Despite its conceptual advantage, the twin births instrument is subject to some concerns. First, Bhalotra and Clarke (2019) argue that, because of selective miscarriage, twin births are more prevalent among higher income individuals, but this is less of a concern during the

Malthusian epoch, when a large share of the population was close to subsistence and poor by today's standards. Second, the crowdsourced data may contain some duplicate entries, as discussed by Kaplanis et al. (2018). Indeed, in our sample, the percentage of twin births is 3.4 percent. For comparison, Bhalotra and Clarke (2019) report that 2.73 percent of births in their sample of 72 countries, and 2.07 percent of births in a narrower sample of developing countries, are twin births. To address this problem, we construct the instrument taking into account only concurrent births (occurring in the same month-year) of different-sex children from the same parents: these are less likely to be duplicate observations, since both children have different sexes. This amounts to about 0.7% of the sample, implying that the "true" incidence of twin births in our sample would be about 1.4% - closer to the overall prevalence of twin births in developing countries today.

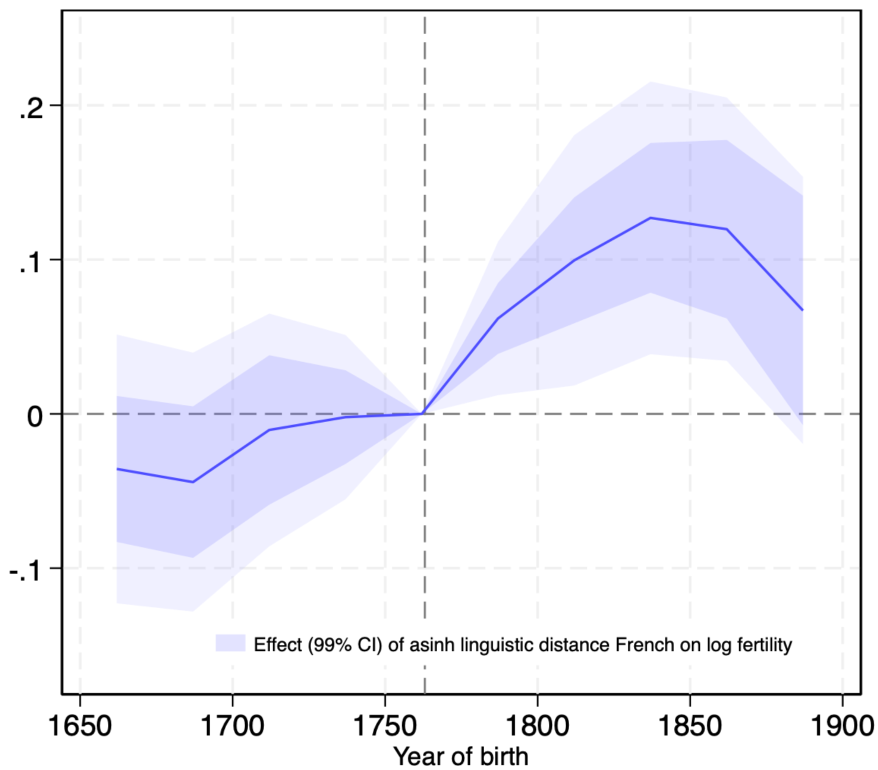
The IV results are presented in Table 4, with standard errors clustered at different levels (parents, municipality, and language). The sample is restricted to individuals born between 1775 and 1875, after the onset of the fertility transition in France but before it began in other countries. During this period, linguistic distance from French and twin births are significant predictors of fertility, and the individuals in the sample are not affected by the border closures of the 1920s. The first two columns report OLS results restricted to this sample, with results very similar to those in the corresponding specifications of Table 3. The remaining columns display IV results, first with linguistic distance as an instrument (columns 3 and 4), then with twin births (columns 5 and 6) and finally with both instruments together (columns 7 and 8).

We can draw several observations from these results. First, the first stage is particularly strong, as shown by the Kleinberger-Paap F-statistic being high, and usually larger than the 104.7 threshold from Lee et al. (2022). This is the case no matter how standard errors are clustered. Second, the estimated IV effect of parental fertility on the probability of migrating to the New World is much larger than its OLS analog, consistent with our earlier discussion of the direction of omitted variables bias. Using the estimate of the last column, the probability of migrating to the New World rises by 4.89 percentage points when comparing individuals born in households with 3 children to those born in households with 4 children. This represents almost half of the increase in the average migration probability to the New World during the Age of Mass Migration, from 6.6 percent for individuals born before 1825 to 17.1 percent for those born after. Third, the fact that we have two instruments opens up the possibility of conducting tests of overidentifying restrictions. In the last two columns, the Hansen J-statistics admit p-values in excess of 0.30, so we fail to reject the null hypothesis of valid instruments.

4.5 Robustness

We subject the results of Table 4 to several robustness tests. First, we re-estimate our results without weighting observations by the population of the country of origin (Appendix Table

Figure 9: Linguistic distance from French and fertility, before and after the fertility transition in France



Note: This figure displays the even study regression of log (parental) fertility on the (inverse hyperbolic sine) linguistic distance from French in the municipality of birth, before and after the fertility decline in France. We interact linguistic distance from French with 25 years period dummies, and report coefficients on the difference with the baseline period, in 1750-1774, when fertility declined in France. Coefficients are plotted centered in the middle of the 25 year period. Standard errors are clustered at the municipality and Ethnologue language levels. The sample consists of parents (in the fertility sample) of children born between 1650 and 1900 in Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, North Macedonia, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, or the UK. To account for the over-representation of some countries, observations are reweighed using the scheme provided by Blanc (2024*b*). The baseline set of controls from column 2 of Table 3 is included.

A7). This adjustment does not alter the direction or statistical significance of our findings for either the OLS or IV results.

Second, we construct the linguistic distance instrument without taking its hyperbolic sine transform first (Appendix Table A8). Once again, the results are quite similar to those of Table 4. In the same table, we also control for linguistic distance to the languages of other colonizers (to English and Spanish). The rationale for this robustness check is to make sure that our instrument does not directly capture a measure of the cost of migrating to the New World (the ability to speak the same language as the colonizer - either Spain for much of Latin America, or England for the US and Canada). The inclusion of these variables does not meaningfully change either the first stage estimate of the effect of linguistic distance from

Table 4: Individual-level determinants of emigration to the New World, instrumental variables estimation

	Dummy = 100 if died in New World							
	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) 2SLS	(6) 2SLS	(7) 2SLS	(8) 2SLS
	Panel A: Second stage							
log Parental fertility	3.67	2.60	16.87	19.42	16.84	14.79	16.71	17.18
	(0.27)***	(0.27)***	(1.52)***	(4.03)***	(6.16)***	(6.34)**	(1.50)***	(3.51)***
	[0.35]***	[0.36]***	[3.13]***	[6.41]***	[5.89]***	[5.89]**	[2.85]***	[5.02]***
	⟨0.38⟩***	⟨0.38⟩***	⟨4.03⟩***	⟨5.91⟩***	⟨5.45⟩***	⟨6.14⟩**	⟨3.60⟩***	⟨5.19⟩***
	Panel B: First stage							
asinh Linguistic distance French			0.15	0.10			0.15	0.10
			(0.01)***	(0.01)***			(0.01)***	(0.01)***
			[0.01]***	[0.02]***			[0.01]***	[0.02]***
			⟨0.01⟩***	⟨0.02⟩***			⟨0.01⟩***	⟨0.02⟩***
Dummy = 1 if parents had twins					0.51	0.49	0.47	0.47
					(0.04)***	(0.05)***	(0.04)***	(0.04)***
					[0.04]***	[0.05]***	[0.04]***	[0.05]***
					⟨0.04⟩***	⟨0.04⟩***	⟨0.04⟩***	⟨0.03⟩***
Kleibergen-Paap F statistic								
Parents level			384.9	79.0	153.7	105.5	262.4	94.4
Municipality level			142.9	26.5	130.6	84.6	135.2	53.9
Language level			118.9	31.8	174.8	161.5	367.0	113.6
p-value of Hansen J statistic								
Parents level							0.79	0.30
Municipality level							0.80	0.30
Language level							0.82	0.30
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country of birth × year of birth FEs		Yes		Yes		Yes		Yes
Observations	153,060	152,897	145,543	145,363	153,049	152,886	145,532	145,352

Note: This table displays the results of the IV regression of a dummy = 100 if an individual died in the New World on log parental fertility. The coefficient on log parental fertility is estimated by OLS in columns 1-2, and by IV after, using as an instrument the (inverse hyperbolic sine) linguistic distance from French in columns 3-4, a dummy that equals one if the individual's parents had (different-sex) twins in columns 5-6, and both variables together in columns 7-8. Standard errors are clustered at the parents, municipality, and Ethnologue language levels. Throughout the table, the sample consists of individuals born between 1775 and 1875 in Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, North Macedonia, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, or the UK, and with parents in the fertility sample. To account for the over-representation of some countries, observations are reweighed using the scheme provided by Blanc (2024*b*). The baseline set of controls from column 2 of Table 3 are included in all specifications. In even columns, we add country of birth by year fixed effects, as in column 4 of Table 3. Further details are provided in Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

French on fertility, or the second stage estimates of the effect of fertility on the propensity to migrate.

Third, with respect to the twin births instrument, we consider an instrument that does not exclude same-sex concurrent births (Appendix Table A9). As expected, the first stage is now stronger, as the correlation between fertility (which includes all observed births) and twin births (i.e. births occurring from the same parents in the same month and year) is stronger. However, the second stage estimate on fertility, while still positive and statistically significant, is now weaker due to increased measurement error in the instrument.

Fourth, in Appendix Table A10, we redefine the dependent variable as taking a value of one if the individual died in the US or Canada (as opposed to the New World more broadly). The goal is to assess whether the decision to migrate to the US and Canada responds differently to parental fertility compared to other destinations in the New World. Columns 1-3 replicate the baseline IV specifications of Table 4, for comparison. Columns 4-5 use the redefined dependent variable, but otherwise uses the same sample and estimation methods. We find that the results are unchanged compared to the broader definition of the dependent variable, in fact the estimated coefficients on log parental fertility is statistically indistinguishable between the two specifications.

4.6 Heterogeneity

In this subsection, we assess various dimensions of heterogeneity in the effect of parental fertility on the propensity to migrate to the New World.

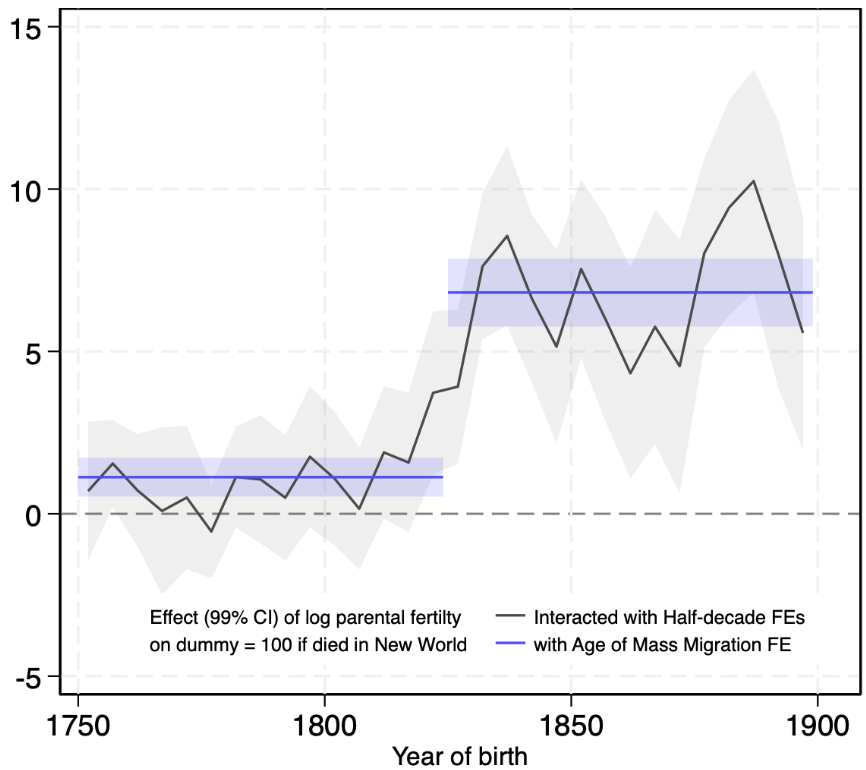
Heterogeneity through time. Figure 10 plots the OLS coefficients from regressions of the emigration dummy on parental fertility interacted with time dummies defined by 5-year periods. The time dummies are coded as of the year of birth of the individual whose migration status is considered. The figure displays a notable feature, and evidence for Fact 6: the effect of fertility on emigration (solid black line) starts out close to zero and increases strongly for those born after 1825.

A structural break for cohorts born in 1825 is notable, as the Age of Mass Migration is generally understood to have started around 1850, and gained steam thereafter. The first transatlantic steam-powered trip occurred in 1838 and was quickly adopted as the primary mode of transatlantic travel in the decades that followed, marking the beginning of the Age of Mass Migration (Abramitzky and Boustan, 2022) and playing a significant role in the first globalization (Pascali, 2017), with time on the crossing falling by more than 80 percent from 1853 to 1900 (Hatton, 2024).

In addition, this period was ripe for an Age of Mass Migration because of the sustained increase in fertility experienced in many sending countries during the 19th century (except, notably, in France). This century represents the height of the Post-Malthusian Epoch, characterized by rapid technological advancements and increases in income triggering a pronounced and durable increase in fertility - as opposed to the preceding period where fertility oscillated around the long-run Malthusian equilibrium (Galor, 2022; Galor and Weil, 2000). Persistently high fertility (and the concurrent reduction in child mortality that happened around the same time) therefore created the conditions for Malthusian migrations: a large reservoir of surplus labor that could find better opportunities in the New World thanks to affordable transatlantic travel and open borders.[19]

[19] Additional reasons why mass migrations did not start earlier could include high mortality for early settlers (Ace-

Figure 10: Effect of parental fertility on emigration to the New World, over time



Note: This figure displays the results of the regression of a dummy = 100 if an individual died in the New World on log parental fertility, interacted with half-decade or Age of Mass Migration (individuals born after 1825) fixed effects, using the baseline specification from column 2 of Table 3. Standard errors are clustered at the parents level, and 95 percent confidence intervals are reported. Further details are provided in Table 3.

In Figure 10, the blue lines represent a simpler sample split between the period before 1825 and after 1825, showing a clear increase in the effect of parental fertility on migration in the second period. For cohorts born between 1825 and 1900, the magnitude is equal to 6.80. However, the effect of parental fertility remains significantly positive even before 1825, indicating that the association between high fertility and increased migration (i.e., Malthusian migrations) was present before the reductions in travel costs that contributed to the Age of Mass Migration. Indeed, for those born before 1825, the effect size is 0.96, which is still statistically significant at the 95% confidence level. These results are consistent with an acceleration of Malthusian migrations once the pressure valve that initially restricted migration is released after 1850 due to improvements in transport technologies and improved conditions in the New World.

moglu, Johnson and Robinson, 2001) and low wages in the Americas until the abolition of slavery (Lambais and Palma, 2023).

Table 5: New or Old World?

	Dummy = 100 if died in New World				Dummy = 100 if died in Europe, in diff. municipality from birth			
	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) OLS	(6) 2SLS	(7) 2SLS	(8) 2SLS
log Parental fertility	3.67	16.87	16.84	16.71	-0.60	1.03	-7.42	0.34
	(0.27)***	(1.52)***	(6.16)***	(1.50)***	(0.49)	(2.83)	(5.87)	(2.66)
	[0.35]***	[3.13]***	[5.89]***	[2.85]***	[0.74]	[6.04]	[6.37]	[5.62]
	⟨0.38⟩***	⟨4.03⟩***	⟨5.45⟩***	⟨3.60⟩***	⟨0.97⟩	⟨7.61⟩	⟨6.27⟩	⟨6.91⟩
Instrument:								
asinh Linguistic distance French		Yes		Yes		Yes		Yes
Dummy = 1 if parents had twins			Yes	Yes			Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	153,060	145,543	153,049	145,532	133,411	127,334	133,402	127,325

Note: This table displays the results of the OLS and IV regressions of a dummy = 100 if an individual died in the New World (Panel A) or in a municipality different from its municipality of birth in the Old World (Panel B) on log parental fertility, using as an instrument the (inverse hyperbolic sine) linguistic distance from French, a dummy that equals one if the individual's parents had (different-sex) twins, and both variables together. Columns 1-4 show the baseline coefficients from the odd columns of Table 4. In columns 5-8, we further restrict the sample to individuals who were both born and died in one of the European countries listed in 3, and redefine the dependent variable as a dummy = 100 if an individual died in a municipality different from its municipality of birth. Standard errors are clustered at the parents, municipality, and Ethnologue language levels. Further details are provided in Table 4. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Heterogeneity across destinations. Our second test of heterogeneity is to examine the effect of parental fertility on the propensity to migrate to the New World versus migrating within the Old World. To do this, we redefine the dependent variable as taking a value of 100 if the individual was born in Europe and died in a municipality other than their municipality of birth. We also limit the sample to those who did not die in the New World. The results are presented in Table 5, providing strong evidence for Fact 7. The first four columns replicate the results previously discussed from Table 4. Columns 5-8 use the alternative outcome variable and restricted sample. We see no significant effect of parental fertility on the propensity to migrate within the Old World - in other words no evidence of Malthusian pressure at the family level as a determinant of intra-Old World migration. This is as we would expect, since most destinations within the Old World still had elevated fertility - and thus little labor scarcity - throughout most of the 19th century. Thus, Malthusian migrations indeed involve movements to low fertility, high economic return areas (the New World), not to high fertility, labor-abundant areas.[20]

Heterogeneity by inheritance systems. Table 6 examines whether the effect of parental fertility on the migration propensity is larger in regions where historical inheritance systems were more egalitarian - finding that it is. To capture inheritance systems, we use

[20]France represents a possible destination within Europe for individuals pushed out by high parental fertility, in other words a possible outlet for Malthusian migrations. Melki et al. (2024) report that France was indeed a land of immigration in the second half of the 19th century - with the contribution of migrant inflows (mostly from the rest of Europe) to overall population growth comparable to the one that prevailed in the US in the same period. France had already long undergone its transition to modern fertility, whereas few other European countries had - it was therefore in need of both agricultural and industrial labor, and became a prime destination for migrants from the rest of Europe. Unfortunately, in our sample there are too few individuals who were born outside of France and died in France to accurately estimate the effect of parental fertility on the propensity to migrate *to France*.

the classification of Duranton, Rodríguez-Pose and Sandall (2009); Todd (1985, 1990). We digitized a map of family types (see Figure A9) to be able to match individuals' municipalities of birth to the Todd classification. The classification contains four categories of family types: communitarian, egalitarian nuclear, stem, and absolute nuclear. Of these, the first two have egalitarian inheritance norms, while the latter two involve unequal norms (usually primogeniture). We assign to the municipality of birth a dummy variable taking on a value of 1 if inheritance norms are egalitarian, and then interact this dummy variable with parental fertility.

Table 6: Fertility, inheritance, and emigration

	Dummy = 100 if died in New World		
	(1)	(2)	(3)
log Parental fertility	4.25***	4.13***	3.07***
	(0.25)	(0.26)	(0.25)
Dummy = 1 if equal inheritance		-2.49***	-6.30***
		(0.46)	(0.74)
log Parental fertility × Dummy = 1 if equal inheritance			2.51***
			(0.56)
Baseline controls	Yes	Yes	Yes
Observations	225,333	225,185	225,185
Adjusted R^2	0.06	0.06	0.06

Note: This table displays the results of the OLS regressions of a dummy = 100 if an individual died in the New World on log parental fertility, when inheritance norms are egalitarian versus when they are not, using the baseline specification from column 2 of Table 3. Standard errors are clustered at the parents level. Further details are provided in the text and in Table 3. Source: Duranton, Rodríguez-Pose and Sandall (2009); Todd (1985, 1990) for inheritance norms. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

In Table 6, the first column replicates the regression of column 2 of Table 3. The second column includes the egalitarian inheritance system dummy, which bears a negative sign. Indeed, under egalitarian inheritance norms, children beyond the first-born receive some share of the inheritance, which lowers their incentive to emigrate. This finding supports Pritchard (2004)'s hypothesis that the limited French migrations to the New World can be attributed to the land tenure system in France: "peasants owned nearly half the land in France and the security of peasant land tenure remained intact" (p. 17). The third column of Table 6 carries out the heterogeneity test, showing that the effect of parental fertility is larger when inheritance norms are egalitarian, as the coefficient on the interaction term is positive and statistically significant.

When parental fertility increases under equal inheritance, each child stands to receive a smaller inheritance, raising their incentives to migrate. In contrast, when the inheritance system is non-egalitarian, parental fertility is less relevant for the migration decision, as only one child stands to inherit (typically the firstborn). Overall, these results provide supporting evidence for Fact 8. Moreover, they help reconcile conflicting empirical findings on the effect of egalitarian inheritance on emigration: some studies find a negative effect (Habakkuk, 1955; Wegge, 1998), others report no effect (Bartels, Jäger and Obergruber, 2024), while D'Amelio (2024) identifies a positive effect on emigration from Italy. For financially constrained households - as was common in 19th-century Italy - inheritance could allow families to afford the costs of migration. Our results suggest indeed that egalitarian inheritance had a negative impact on emigration, but that this impact was much weaker, if not positive, when fertility was high - and households were closer to subsistence. Additionally, the fact that the effect of fertility was much smaller when travel costs were higher, prior to steamship travel, suggests that financial constraints could indeed have played some role.

Heterogeneity by birth order. Our last test of heterogeneity is to look at whether the effect of parental fertility varies by the birth order of the child whose migration decision we seek to explain. Our framework predicts that the first-born male should have a lower propensity to migrate - especially under primogeniture - because they tend to receive more resources at inheritance. Moreover, the effect of parental fertility on migration decisions should be lower for first-born males, as they are not greatly influenced by the number of siblings especially when inheritance norms favor the first-born. A corollary of this hypothesis is that the child's birth order should be positively correlated with the decision to migrate, and that the interaction between parental fertility and birth order should also bear a positive coefficient - again especially under egalitarian inheritance norms.

This is precisely the pattern that we uncover in Table 7, which provides evidence in favor of Fact 9. In this table, we are now able to control for parental fixed effects, and identify the effect of parental fertility from within-household variation in the birth order of children (naturally, we are no longer able to estimate the effect of parental fertility alone). Columns 1-3 look at the effects of a dummy variable equal to 1 if the individual is a first-born male. We find, first, that being a first-born male is negatively correlated with migrating to the New World. Second, the interaction between the first-born male dummy and log parental fertility is negative, indicating that the effect of parental fertility on the incentive to migrate is lower for the first-born male than for the other siblings. Third, the triple interaction term between the first born male dummy, parental fertility and the dummy for egalitarian inheritance norms is negative - indicating that the lower propensity of first-born males to migrate to the New World, when parental fertility rises, is particularly pronounced in locations where first-born males are greatly advantaged in terms of inheritance. Columns 4-6 mirror these results closely, but the main independent variable of interest is now simply the birth order of the child (a count variable). The signs are now reversed, but tell the same story: later born children

Table 7: Birth order, fertility, inheritance, and emigration, with parental fixed effects

	Dummy = 100 if died in New World					
	(1)	(2)	(3)	(4)	(5)	(6)
Birth order	0.15	-0.93*	-0.20			
	(0.15)	(0.54)	(0.50)			
_____ x log Parental fertility		0.41**	0.07			
		(0.20)	(0.18)			
_____ x log Parental fertility x Dummy = 1 if equal inheritance			0.99**			
			(0.39)			
Dummy = 1 if first born male				-0.41	1.84*	-0.08
				(0.39)	(1.01)	(1.02)
_____ x log Parental fertility					-1.33**	-0.13
					(0.57)	(0.57)
_____ x log Parental fertility x Dummy = 1 if equal inheritance						-2.91**
						(1.25)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Parental FEs	Yes	Yes	Yes	Yes	Yes	Yes
All interacted terms and FEs			Yes			Yes
Observations	147,153	147,153	147,039	147,153	147,153	147,039
Adjusted R^2	0.707	0.708	0.707	0.707	0.708	0.707

Note: This table displays the results of the OLS regressions of a dummy = 100 if an individual died in the New World on birth order (or, in columns 4-6, a dummy = 1 if first born male), interacted with log parental fertility and a dummy = 1 when inheritance norms are egalitarian, using the baseline specification from column 2 of Table 3 and controlling for parental fixed effects in all specifications, therefore exploiting within-household variation. In columns 3 and 6, reporting the results of the triple interaction, we further controls for all interacted terms and FEs: dummy = 1 when inheritance norms are egalitarian, its interaction with log parental fertility, and its interaction with birth order (in column 3) or a dummy = 1 if first born male (in column 6). Standard errors are clustered at the parents level. Further details are provided in the text and in Table 3. Source: Duranton, Rodríguez-Pose and Sandall (2009); Todd (1985, 1990) for inheritance norms. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

are more likely to migrate to the New World (column 4), their migration propensity is more responsive to increases in parental fertility (column 5), and the latter effect is particularly pronounced under equal inheritance norms. These results indicate that, within households, the most constrained children in terms of resources (those who are not first born, or who have high birth orders) are the most likely to respond to high parental fertility by leaving to the New World - exactly in line with the idea of Malthusian migration.

These results, obtained with a demanding specification that includes parental fixed effects, provide strong empirical evidence that Malthusian pressures were a strong driver of migration to the New World in the period 1750-1900. They are consistent with the findings of Hatton and Williamson (1993), who examine the determinants of out migration from Ireland in the aftermath of the famine of the 1840s. They write: "Though our family size variable is a crude indicator, the results are consistent with the hypothesis that one or two children either inherited or married an inheritor, but the "surplus" siblings typically faced the choice of becoming poor landless laborers or emigrants" (p. 597). To our knowledge, Hatton and Williamson (1993) is the only paper, prior to ours, to empirically examine the relationship between family size and the migration decision. However, they do so in a narrower geographical and historical context, and their measure of family size is cruder than our crowdsourced measure of fertility. The latter is used as a control rather than the main focus of their regression analysis, and unlike us they do not empirically assess the role of inheritance systems.

5 International Migrations, 1990-2020

5.1 Stylized fact

In this section, we show that the historical relationship between migration and fertility remains pertinent in today's context.

Fact 10. *In contemporary data, within-country changes in fertility rates predict rates of emigration.*

5.2 Specification and data

We use panel data on international migrant stocks from United Nations (2020), combined with World Development Indicators (2024) data on fertility and other control variables (GDP per capita, population). Using this data, we estimate the following specification to provide evidence for Fact 10:

$$\text{log emigrants per capita}_{i,t} = \alpha_i + \gamma_t + \beta_1 \times \text{TFR}_{i,t} + \beta_2 \times \text{TFR}^2_{i,t} + \gamma' Z_{i,t} + \varepsilon_{i,t} \quad (5)$$

where TFR_{it} refers to the total fertility rate in country i in five-year period t (between 1990 and 2020), $Z_{i,t}$ is a vector of controls that includes GDP per capita and population density (and their squares), and α_i and γ_t are country and year fixed effects, respectively. The main variable of interest and the controls are introduced along with their squares, following the quadratic specification in Clemens (2020).

5.3 Empirical findings

The results are presented in Table 8, showing a significant relationship between log emigrants per capita and the total fertility rate within countries. This relationship is quadratic: at low levels of fertility, an increase in the TFR is weakly associated with a decline in migration, but at levels of TFR exceeding about 3.5 children per woman, the relationship turns more strongly positive. For example, the derivative of the dependent variable with respect to the TFR is about -0.01 when TFR is equal to 3, but it is about .19 when TFR is equal to 5 (using the estimates of column 3). To show these results visually, Figure 11 plots the relationship using the estimates of column 3 of Table 8.

To summarize, at high levels of fertility, we do uncover a positive relationship between fertility and emigration, showing the continued relevance of our historical results in a contemporary

Table 8: Determinants of emigration today, in a panel of countries

	log Emigrants per capita		
	(1)	(2)	(3)
Total fertility rate	-0.45***	-0.37***	-0.31**
	(0.10)	(0.11)	(0.13)
Total fertility rate squared	0.06***	0.05***	0.05***
	(0.01)	(0.01)	(0.01)
argmin log Emigrants per capita	3.76***	3.40***	3.24***
	(0.40)	(0.41)	(0.51)
GDP per capita		Yes	Yes
Population density			Yes
Observations	1,458	1,360	1,360
Clusters (countries)	209	205	205
Adjusted R^2	0.970	0.976	0.976

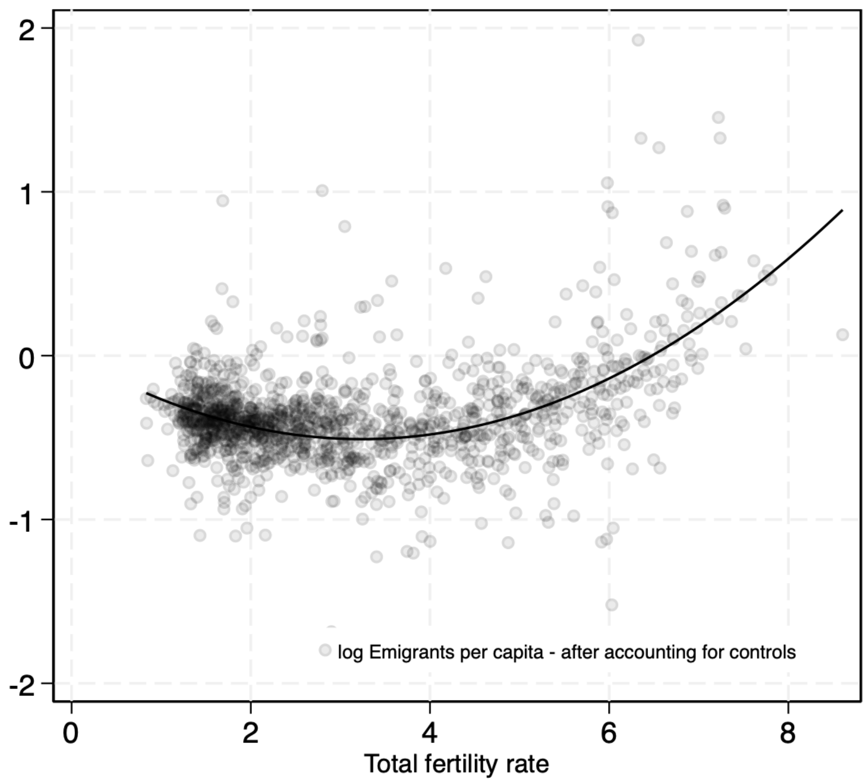
Note: This table displays the results of the OLS panel regression of the log of the emigrant stock per capita on (a quadratic in) the total fertility rate in the sending country, across countries and half-decades, between 1990 and 2020, with country and year fixed effects. The following set of controls are included: a quadratic in GDP per capita and a quadratic in population density. The row "argmin log Emigrants per capita" gives the estimated level of fertility minimizing the log Emigrants per capita in this regression. Observations are weighed by population in the sending country in the year of observation. Sources: United Nations (2020) for international migrant stocks, World Development Indicators (2024) for population, GDP per capita, and population. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

setting. Although the world is no longer Malthusian, fertility rates continue to differ significantly across regions. In 1990, 100 countries had a total fertility rate exceeding 3.5 children per woman (World Development Indicators, 2024), so the type of Malthusian migrations that we documented in a historical context appears to be operative in explaining these countries' emigration flows today. Similarly, in recent decades, many countries such as China and South Korea experienced pronounced declines in fertility rates (Delventhal, Fernández-Villaverde and Guner, 2024; Jones, 2022), suggesting they may no longer be significant origins for emigrants. Fact 10 suggests that these patterns influence both the magnitude and provenance of migration flows.

6 A Model of Malthusian Migrations

In this section, we propose a model allowing for the possibility of emigration in an otherwise standard Malthusian model. As a reminder, the classic Malthusian economy features a land constraint (this fixed factor generates a trade-off between income per capita and population density) and population growth that is linear in income (Ashraf and Galor, 2011). In such a context, the possibility of mass emigration is expected to raise wages and incomes in the sending country, as originally observed by Arthur Lewis (1954, p. 177).

Figure 11: Determinants of emigration today, in a panel of countries



Note: This figure displays the partial residual plot between log of the emigrant stock per capita and (a quadratic in) the total fertility rates in sending countries, across countries and half-decades, after accounting for the controls from column 3 of Table 8.

6.1 Setup of the model

Households. We consider a two-period overlapping generations economy in discrete time ($t \in \{1, 2, \ldots, +\infty\}$). Agents live through childhood (where they are supported by their parents) and parenthood (where they support the next generation). They maximize utility defined over consumption c_t and the number of offspring n_t

$$(6) \qquad \max_{\{c_t, n_t\}} u(c_t, n_t) \equiv \gamma \ln(c_t) + (1-\gamma)\ln((1-p_t)n_t) \quad \text{s.t.} \quad c_t + \rho n_t \leq y_t; \quad \gamma \in (0,1)$$

In the above maximization problem, $\rho > 0$ is the cost of raising each child, y_t is the wage (i.e. per capita income), and p_t is the share of offspring who migrate away. Migration can occur only once, after childhood but before adulthood. In this specification, agents only value remaining children, but they pay the cost of raising every child, including those who migrate away. As a result, fertility choices do not depend directly on the probability of migration p_t

(fertility will depend indirectly on migration through the effect of migration on per capita income). This formulation of the household's problem is equivalent to one in which parents only invest in the children that will not migrate away, an amount equal to $\rho/(1-p_t)$, and zero for those who will migrate - which can help explain why later-born children tend to be those who migrate.

The solution to this problem is as follows, with $\kappa \equiv (1-\gamma)/\rho$ a measure of intrinsic fertility:

$$\begin{cases} c_t = \gamma y_t \\ n_t = \kappa y_t \end{cases} \tag{7}$$

Production. There is one good, no property rights on land X, which is in fixed supply, and production is Cobb-Douglas: $Y_t = (A_t X)^\alpha L_t^{1-\alpha}$, with $\alpha \in (0,1)$. We can rewrite:

$$y_t = Y_t/L_t = (AX/L_t)^\alpha \tag{8}$$

Migration. Our main deviation from the standard Malthusian model is to allow for migration, which is subject to frictions. The probability of migrating has two components. The first component, $\lambda \in [0,1]$, governs the ease of migration. It represents the probability that an opportunity to migrate arises. We can think of it as resulting, for instance, from the existence of a destination (e.g. the discovery of the New World raised the magnitude of λ), and the cost of migrating there (e.g. the invention of the steamship further increased λ, while the US border closure in the 1920s decreased it). The second component is a function, $m(\cdot)$, a probability which depends negatively on the ratio of incomes at the origin (y_t) and at the destination (y^*). It reflects the benefits of migration, consistent with findings from the literature on the economic determinants of emigration (Hatton, 1995; Hatton and Williamson, 1994, 1998). For a given household, $m(y_t/y^*)$ captures the latent desire to migrate conditional on receiving the opportunity to do so.

Thus, the probability of migrating is given by the law of total probability:

$$p_t = \lambda \times m\Big(\frac{y_t}{y^*}\Big); \tag{9}$$

This specification of the migration probability contains the main components of Malthusian migrations: first, migration can only happen if there is an opportunity to migrate (captured by λ). Second, the propensity to migrate depends on levels of income at the origin and destination. In particular, a lower level of income at origin raises the probability of migrating.[21] Third, income at origin is an endogenous variable, responding to Malthusian forces: the higher is intrinsic fertility κ, the lower the income, and the higher the probability of migrating.

[21] Additionally, there is no migration when income at origin is larger than income at destination: if $y_t > y^*$, then $m(y_t/y^*) = 0$.

6.2 Laws of motion

With these assumptions, we are set up to derive the laws of motion of population and per capita income. We begin by noting that $L_{t+1} = L_t n_t (1 - p_t)$ and that $y_{t+1} = (AX/L_{t+1})^{\alpha}$. Substituting the expressions for the optimal number of children (Equation (7)), for the production function (Equation (8)), and for the probability of migration (Equation (9)), we obtain:

$$\text{(10)} \qquad \begin{cases} L_{t+1} = L_t \kappa y_t (1 - \lambda m(y_t/y^*)) \equiv \phi(L_t; A, X, \alpha, \kappa, \lambda, y^*) \\ y_{t+1} = y_t^{1-\alpha} \kappa^{-\alpha} (1 - \lambda m(y_t/y^*))^{-\alpha} \equiv \psi(y_t; \alpha, \kappa, \lambda, y^*) \end{cases}$$

When $\lambda = 0$, we are back to Ashraf and Galor (2011). We focus below on the case where $\lambda > 0$. Since $m'(y_t/y^*) < 0$, it is straightforward to see that $\phi_A > 0$, $\phi_X > 0$, $\phi_\kappa > 0$, $\phi_\lambda < 0$, $\phi_{y^*} < 0$. Similarly, $\psi_\kappa < 0$, $\psi_\lambda > 0$, $\psi_{y^*} > 0$. In other words, population in the next period depends positively on the level of technology A and land X, positively on the household's intrinsic fertility κ, and negatively on both the ease of migration λ and the attractiveness of the migration destination, captured by y^*. The first two forces are standard Malthusian forces, while the remaining ones represent the novel migration-based escape valve that we highlight in this paper. Turning to income per capita, the comparative statics reveal that income per capita in the next period depends negatively on intrinsic fertility (again, a standard Malthusian force) and positively on both the ease of migration and the attractiveness of the destination (because the migratory escape valve is equivalent to a Malthusian positive check - much like mortality in Malthus).

Finally, in Equation (10), there are two effects of lagged income on current income (and similarly for population): first, there is a direct positive effect captured by the term $y_t^{1-\alpha}\kappa^{-\alpha}$. Second, there is a negative indirect effect that goes through the probability of migration, captured by the term $1 - \lambda m(y_t/y^*)$. The latter effect is negative because if y_t increases, there is less migration, population is higher, and per capita income is lower because of the land constraint. These observations will come in handy when we characterize the steady-state, a task to which we now turn.

6.3 Steady-state

To characterize the steady-state(s), we set $\bar{L} = L_{t+1} = L_t$ and $\bar{y} = y_{t+1} = y_t$ (we ignore the trivial steady-states where $\bar{L} = 0$ and $\bar{y} = 0$). This yields $\bar{L} \equiv \widetilde{\phi}(A, X, \alpha, \kappa, \lambda, y^*)$ and $\bar{y} \equiv \widetilde{\psi}(\alpha, \kappa, \lambda, y^*)$, such that:

$$\text{(11)} \qquad \bar{L} = AX\bar{y}^{-1/\alpha} \text{ and } \bar{y} = \frac{1}{\kappa(1 - \lambda m(\bar{y}/y^*))}$$

Importantly, there is a negative relationship between income per capita and population in the steady-state, a classic feature of the Malthusian world. Additionally, when migration is allowed ($\lambda > 0$), the steady-state level of income per capita is always greater than when there is no migration ($\lambda = 0$): $\bar{y} > \kappa^{-1}$. However, without specifying a functional form for m, there is no closed-form solution for the steady-state levels of population and income per capita. That said, existence of a non-trivial steady-state is ensured as y_{t+1} crosses the 45° line at some point, and so does L_{t+1}, since $\lim_{L_t \to 0} \phi_L > 1$, $\lim_{y_t \to 0} \psi_y > 1$, $\lim_{L_t \to +\infty} \phi_L < 1$, and $\lim_{y_t \to +\infty} \psi_y < 1$ (Appendix 3). However, we cannot rule out multiple equilibria since there are contrasting effects of lagged income and population on their contemporary counterparts, as noted at the end of the previous sub-section.

These equilibria do possess some general properties, which we derive in Appendix 3 using the implicit function theorem applied to the equations in (11). These properties are similar to those we identified for the laws of motion. For $\bar{y}$, $\widetilde{\psi}_A = \widetilde{\psi}_X = 0$, $\widetilde{\psi}_\kappa < 0$, $\widetilde{\psi}_\lambda > 0$, and $\widetilde{\psi}_{y^*} > 0$. For $\bar{L}$, $\widetilde{\phi}_A = \widetilde{\phi}_X > 0$, $\widetilde{\phi}_\kappa > 0$, $\widetilde{\phi}_\lambda < 0$, and $\widetilde{\phi}_{y^*} < 0$.

In words, these comparative statics results illustrate the main mechanisms at play in our migration-augmented Malthusian model, especially the role of migration as an escape valve. First, intrinsic fertility (κ) exerts a negative effect on per capita income (and a positive effect on population) but this effect is counterbalanced by the possibility of migrating, as the opportunity to migrate (λ) has a positive effect on income (and a negative effect on population). This is the central mechanism in this paper, namely the migration-based escape valve from Malthusian forces. This escape valve is further illustrated by the fact that income at origin countries is increasing in income at destination (y^*), because more people emigrate when destination income is higher. Second, the basic properties of the Malthusian model are preserved, namely that technology (A) and land (X) have no effect on steady-state income, because they exert a positive effect on steady-state population, and that higher intrinsic fertility leads to a larger population.

To further illustrate the properties of the steady-state, we assume a specific functional form for m: $m(y_t/y^*) = 1 - y_t/y^*$.[22] In that case, as shown in Appendix 3, there is a unique steady-state with a closed-form solution:

$$\bar{y} = y^* \times \frac{\sqrt{(1-\lambda)^2 + (4\lambda/\kappa y^*)} - (1-\lambda)}{2\lambda} \tag{12}$$

It is easy to check that, if $y^* > \kappa^{-1}$, then $\bar{y} < y^*$. In words: suppose income per capita in the New World is higher than the steady-state level of income per capita would be in the Old World without emigration (in which case $\bar{y} = \kappa^{-1}$). Then, when allowing for migration from the Old World, there is a unique steady-state level of income per capita $\bar{y}$ such that $\bar{y} < y^*$. This seems like a reasonable scenario, since abundant land in the New World ensures elevated per capita income there. In this case, immigration from the Old World does not erode per

[22]This is a special case of Enguehard (2023), who assumed that $m(y_t/y^*) = 1 - (y_t/y^*)^\mu$. In our case, $\mu = 1$.

capita income in the New World because new land can be exploited without eroding the level of y^*, for instance by pushing out the frontier.

7 Conclusion

Malthusian migrations are population movements from land-scarce, labor-abundant locations to land-abundant, labor-scarce destinations. In this paper, we provide the first exploration of such migrations, both empirically and theoretically. We argue that Malthusian migrations are essential for understanding the global spread of populations: past variations in fertility rates carry with them stark implications for the distribution of diasporas. Societies with early fertility transitions followed by persistently low fertility rates, like France, have descendants that are mostly concentrated in their original homeland. Countries that experienced late fertility transitions, like Italy, instead have diasporas that are many times the size of their current populations. These facts can help us understand the timing and pattern of European development in the second half of the 19th century, since Malthusian migrations afforded an escape valve allowing standards of living to rise despite persistently high fertility rates.

Empirically, we document the existence of Malthusian migrations in four different datasets, uncovering a strong relationship between fertility and emigration. Our results also hold in contemporary data, for societies still exhibiting very high levels of fertility. During the Age of Mass Migrations, a series of factors conspired to make Malthusian migrations particularly potent: an increase in fertility rates in many European societies, raising migratory pressures along the transition from stagnation to growth; a reduction in migration costs, stemming from the adoption of steamship travel, allowing for mass migrations from the Old World; and welcoming immigration policies on the part of New World societies. Once European societies experienced their fertility transitions, their emigration rates collapsed. Yet, while our emphasis is on Post-Columbian population movements, our insights could account for earlier instances of large-scale human migrations, such as the Out-of-Africa migrations, the Indo-European migrations, or the Bantu migrations. Moreover, our results have implications for contemporary migratory movements, as more and more developing countries transition to low levels of fertility.

Theoretically, we develop a model which allows for a migration-based escape valve from Malthusian dynamics. The model carries novel and stark implications for the relationship between fertility and migration on the one hand, and for the relationship between migration and standards of living on the other hand. The model predicts that an increase in the intrinsic determinants of fertility (a greater weight on children relative to consumption in the utility function, or a fall in the cost of raising children) will lead to more migration. The reason is that higher fertility increases population, and creates more pressure to use the escape valve of migration. In addition, a higher level of migration, brought about for instance by a reduction in migration costs, implies a smaller population in the country of origin, leading to higher per capita income through standard Malthusian mechanisms. This opens up the possibility that migration could facilitate an escape from Malthus and a transition to modern growth. In our model, therefore, traditional Malthusian forces are at play, but migration creates an escape valve that allows standards of living to remain higher than they would have otherwise been.

More than 60 million Europeans left for the New World in search for better opportunities during the Age of Mass Migrations, a number so large that it likely had a significant effect on living standards in sending countries. Consider England, which had 5.5 million inhabitants in 1750. By 2020, there were 131.9 million English-descended people around the world, including 53.2 in England. Without emigration, the transition to modern growth would likely have been delayed.

More generally, Malthusian migrations suggest that settler colonization benefited European societies in more ways than are usually highlighted. Europeans derived substantial benefits from the violent subjugation of colonized populations and extraction from their empires in the colonial era. But settler colonization was a potent determinant of European development in another important way: by allowing European societies to escape from the Malthusian dynamics that had kept them in poverty for so long.

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The online appendix for this paper can be found **here**.